# THE JOURNAL OF AGRICULTURE OF WESTERN AUSTRALIA.

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# The JOURNAL OF THE DEPARTMENT OF AGRICULTURE
WESTERN AUSTRALIA

VOL. 6 (Third Series) NOVEMBER–DECEMBER, 1957 No. 6

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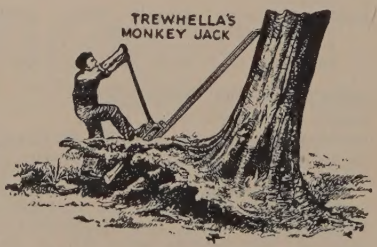

# Worms in Sheep . . .

By C. R. TOOP, B.V.Sc., Chief Veterinary Surgeon

**THE parasitic worms of sheep are widely distributed throughout Australia and are a source of serious loss to the sheep and wool industry. This results from the loss of condition which occurs in infested animals as well as from the failure of young sheep to thrive and make normal growth, and there is a consequent reduction both in carcass values and in the quantity and quality of wool produced. Furthermore, heavy infestations with worms are frequently responsible for serious mortalities.**

In Western Australia on account of the long, dry summer which is unfavourable to the development of worm eggs and larvae, these losses are not so serious as those which occur in parts of Eastern Australia which are favoured by a summer rainfall or an evenly distributed annual rainfall, but they are nevertheless quite considerable.

For the most part, they are sustained during the dry months of summer but are by no means infrequent during winter in the South-West.

Severe losses have often occurred in the late summer and early autumn, especially when the autumn rains are scanty or delayed. In these outbreaks the large-mouthed bowel worm is often seen in large numbers. Outbreaks of "barber's pole worm" infestation have been seen from September to November. Fortunately the nodule worm which flourishes in areas of summer rainfall does not occur in this State.

The majority of sheep harbour some worms, but the effect upon the animal will obviously depend upon the number of parasites present and in addition it will be influenced to a very considerable extent by the nutritional conditions which prevail.

The presence of a few worms is of little consequence and will produce no apparent ill-effect upon the health of the animal. A heavy infestation on the other hand, may set up well-marked symptoms of disease often accompanied by heavy mortality.

## AVOIDING WORM INFESTATION

Nutrition is of the utmost importance. A well-nourished sheep is quite often able to resist the effects of an infestation which might prove fatal in the case of an animal in poor condition which is forced to exist upon a much lower level of nutrition. The influence of nutrition is well illustrated in the outbreaks of worm infestation which occur in this State during summer.

The majority of the worms harboured by the sheep are probably picked up from the pastures during late winter and spring when the warm moist conditions which then prevail are favourable to the development of the parasites.

The sheep show no ill-effects while there is an abundance of succulent green feed available but when the feed dries off and its nutritive value is reduced, the effect of the infestation becomes apparent declaring itself in a well marked loss of condition together with the develoment of other more or less characteristic symptoms.

A series of field trials carried out in recent years in collaboration with C.S.I.R.O. has shown that heavy infestations are often acquired in the late summer and early autumn months, especially with large-mouthed bowel worm and black scour worm. As soon as the autumn feed comes away the sheep tend to rid themselves of the infestation but, if the rains are delayed and the feed does not respond, severe losses from worm infestation may occur.

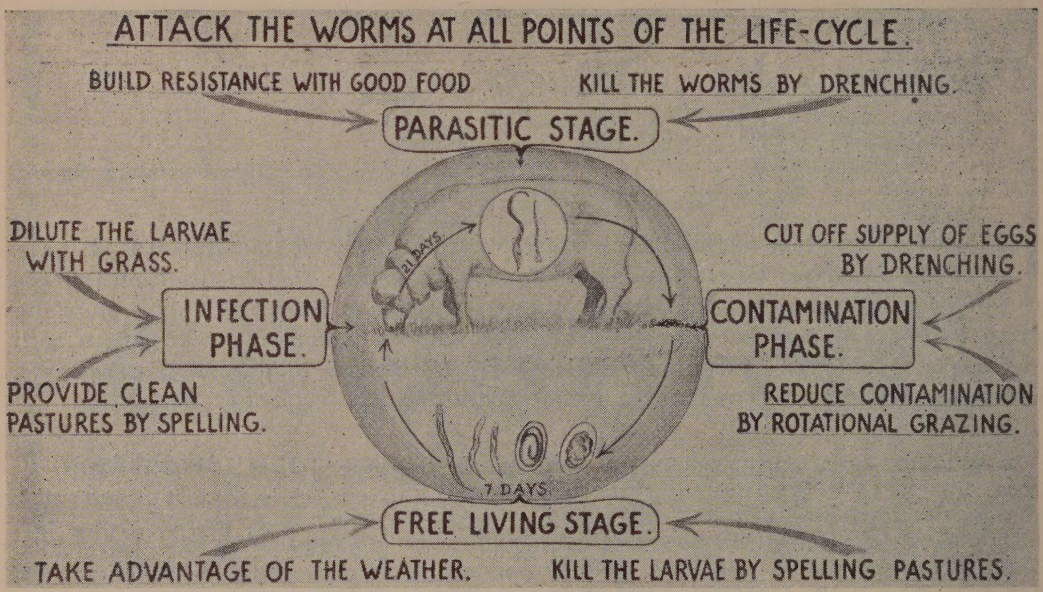
ATTACK THE WORMS AT ALL POINTS OF THE LIFE-CYCLE.
BUILD RESISTANCE WITH GOOD FOOD
KILL THE WORMS BY DRENCHING.
PARASITIC STAGE.
DILUTE THE LARVAE WITH GRASS.
CUT OFF SUPPLY OF EGGS BY DRENCHING.
INFECTION PHASE.
CONTAMINATION PHASE.
21 DAYS
PROVIDE CLEAN PASTURES BY SPELLING.
REDUCE CONTAMINATION BY ROTATIONAL GRAZING.
7 DAYS
FREE LIVING STAGE.
TAKE ADVANTAGE OF THE WEATHER.
KILL THE LARVAE BY SPELLING PASTURES.

Fig. 1.—A diagram showing the life-cycle of the sheep worms, with suggestions for worm control at all stages.

The importance of maintaining sheep in good condition and hence increasing their resistance, to worm infestation by the provision of improved pastures and hand feeding during the summer months cannot be over-emphasised as a control measure. Under West Australian conditions it is of paramount importance.

The establishment of a heavy worm infestation will depend upon the climatic conditions and the degree to which the pastures are contaminated by worm eggs passed out by infested sheep. Moisture is essential to the development and survival of worm eggs and larvae, and as a consequence serious infestations are more likely to occur in districts which enjoy a favourable rainfall.

Heavy stocking leads to heavy contamination of the pastures. Low-lying areas which remain moist and green during summer and in which the sheep congregate in large numbers, are especially dangerous in this respect.

Because of these factors, worm infestation may become a serious problem in the agricultural districts and particularly in the areas of higher rainfall and high carrying capacity, whereas in the dry, lightly stocked pastoral areas it is a matter of little concern.

The susceptibility of sheep to worm infestation varies considerably. Lambs particularly, and breeding ewes, are especially susceptible and particular attention must be paid to such animals when control measures are receiving consideration.

Older sheep, as the result of previous exposure to infection, develop a well marked resistance to the parasites. In breeding ewes this resistance may be broken down by the additional burden of pregnancy and lactation.

## DIAGNOSIS

Sheep suffering from worm infestation exhibit well-marked symptoms of disease. Unthriftiness and loss of condition invariably occur. When these symptoms make their appearance the presence of worms may be suspected. From a consideration of the more or less characteristic symptoms which subsequently develop, it is frequently possible to form an opinion with regard to the identity of the parasite which is actually responsible.

In all cases, however, the diagnosis should be established by the post mortem examination of an affected sheep. An animal showing typical symptoms should be selected for examination. Sheep which

have recently died or which are showing advanced symptoms of disease and are in extremely weak condition are not suitable subjects for examination. In such cases the majority of the worms may have been passed out and the result of the examination may in consequence be misleading. It is important that the species of worm present should be identified since this will determine the type of treatment which must subsequently be adopted.

In this connection it must be recognised that sheep may harbour a considerable variety of parasites. Some of these are capable of producing serious effects. All parasites are capable of causing disease, but some species are of much greater importance than others. Disease depends on the number of worms and the duration of the infestation.

The parasites inhabiting the digestive tract of sheep always occur in the same location and are not normally found elsewhere. The large stomach worm, for example, is always found in the fourth stomach; the *Trichostrongyles* or hair-worms are confined to the first 15-20 feet of the small intestine.

The digestive tract of a sheep is shown in the accompanying illustration, reference to which will enable the various portions to be recognised.

The stomach of the sheep is large and voluminous, occupying all of the left side and portion of the right side of the abdominal cavity. It is divided into four compartments, viz.,

(1) the rumen or paunch;
(2) the reticulum or "honeycomb" which will be recognised because of the honeycomb like structure of its lining membrane;
(3) the omasum or "bible," so called on account of the numerous longitudinal folds or "leaves" which it contains;
(4) the abomasum or fourth stomach.

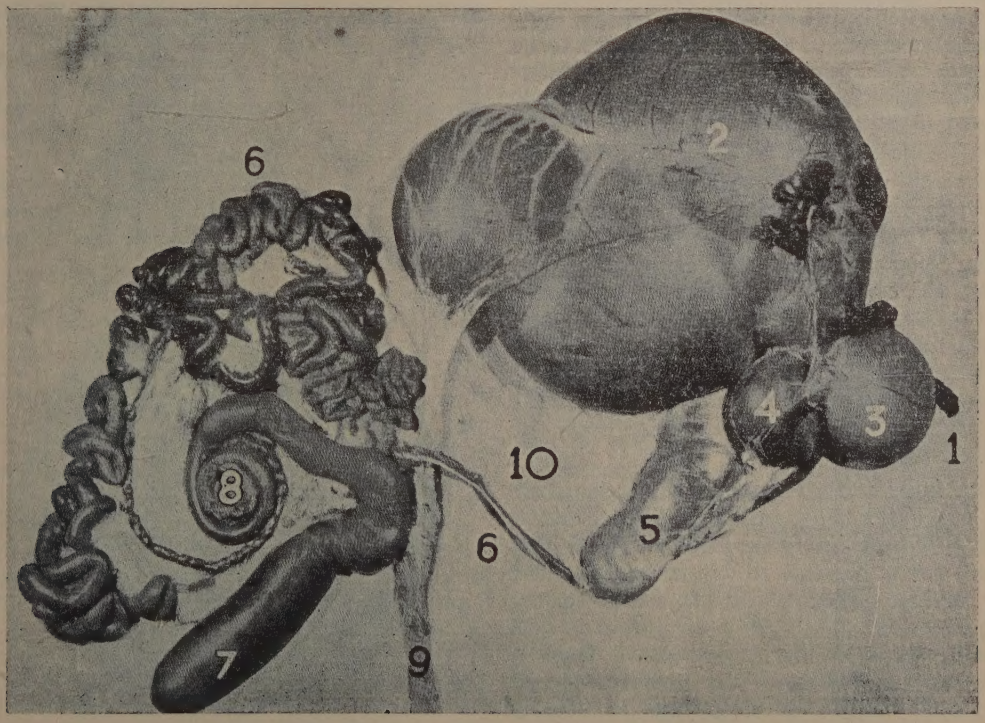


Fig. 2—THE DIGESTIVE TRACT OF A SHEEP—1. Oesphagus (gullet); 2. Rumen (first stomach or paunch); 3. Reticulum (second stomach or honeycomb); 4. Omasum (third stomach or bible; 5. Abomasum (fourth stomach or rennet); 6. Small intestine (runners); 7. Caecum (blind gut); 8. Colon (crown); 9. Rectum (hind gut); 10. Omentum (caul).

(After Clunies Ross & Gordon.)

In Western Australia no parasites of any kind occur in the first three stomachs of sheep. The small intestine, popularly known as the "runners," is about 80 feet in length and extends from the fourth stomach to the caecum or blind gut. The caecum in turn passes on to the large intestine which is about 15 feet in length. The first portion is much coiled and is known as the colon or "crown." The terminal portion through which the contents of the bowel are discharged to the exterior is known as the rectum or hind gut.

When conducting an examination the digestive tract should be removed from the body cavity and the intestines should be freed from their attachments. Commencing at the fourth stomach the digestive tract should be laid open with scissors and its contents, together with the lining membrane to which the parasites may be adhering should be examined for the presence of worms. Particular attention should be paid to sections, such as the fourth stomach and the first 20 feet of the small intestine, in which worms capable of producing serious effects are to be found. A conclusion that the symptoms exhibited by the sheep are attributable to worm infestation will only be justified if a large number of parasites are discovered.

An alternative but less reliable method of diagnosis consists of the examination of the droppings for the presence of worm eggs. In order that such an examination may be of value, samples of droppings obtained from a representative number of both healthy and affected sheep must be submitted, and the work must be supervised by a veterinarian who will be able to place a correct interpretation upon the result obtained.

Cultures of the droppings must be made in order that the worm larvae which hatch from the eggs may be identified. By this means it is possible to determine the kind of worms present and to estimate the numbers in which they are present. It must, however, be emphasised that a diagnosis based upon the examination of a signle sample of droppings is usually quite unreliable and may in consequence involve the sheep owner in needless worry and expense.

The worms which have been recorded in sheep in this State are described in the succeeding paragraphs. Those which are known to produce serious effects will be dealt with in some detail. The remainder will be mentioned briefly in order that they may be recognised should they be encountered.

## THE LARGE STOMACH WORM OR BARBER'S POLE WORM (Haemonchus contortus)

This is one of the most serious of the internal parasites found in sheep in Western Australia, chiefly because it increases very rapidly and kills sheep by blood-sucking. It may cause disease in sheep of all ages but is especially important in lambs, weaners and breeding ewes.

It occurs in the abomasum or fourth stomach. The female worm is about 1¼ inches in length and shows a red and white spiral striping from which the popular name "barber's pole" worm is derived. The males are smaller in size and uniformly red in colour. These parasites are readily visible and at post mortem may be observed moving freely in the stomach contents or adhering to its wall. The large stomach worm is a vigorous blood sucker. When the infestation is heavy large quantities of blood are withdrawn from the animal which consequently becomes affected by severe anaemia.

Fig. 3.—LARGE STOMACH WORM *(Haemonchus contortus)*—natural size. The female worm shows a red and white spiral striping and is popularly known as the "barber's pole worm."
(After F. H. S. Roberts.)

Fig. 4.—These sheep are heavily infested with the large stomach worm or "barber's pole worm." Note the typical soft swelling under the jaw ("bottle-jaw"). In a heavy infestation, the worms may take up to three-quarters of a pint of blood from the sheep every day, producing an anaemic condition. The milk supply of the ewes can be considerably reduced.

**Symptoms.**

The effects of infestation with the large stomach worm are in general most serious in young sheep and breeding ewes. All types of sheep may, however, become affected. The symptoms usually make their appearance during the summer months; less often in early winter. Affected sheep steadily lose condition, becoming poor, unthrifty and often "pot-bellied" in appearance. Such sheep become weak and sluggish, do not move about the paddocks freely and spend less time in feeding. They are usually difficult to drive and may fall to the ground from weakness after proceeding a short distance. Upon examination the skin and mucous membranes of the mouth and eyes will be found to be extremely pale in colour. In advanced cases there may be a well-marked break in the wool. Later a soft swelling appears beneath the lower jaw ("bottle jaw"). This symptom is characteristic of stomach worm infestation. Affected sheeep become progressively poorer and weaker in condition and without treatment will usually succumb. Sometimes as the result of a massive and rapidly acquired infection, mortality may occur amongst sheep in fat condition, death being due to the sudden and heavy loss of blood which is withdrawn by the parasites.

**Post Mortem Appearances.**

The blood is reduced in quantity and watery in appearance, The carcass is light and emaciated, the fat being replaced by gelantinous material.

In heavy infestations sheep may be "bled to death" before there has been time for them to lose condition and deaths have been seen in fat lambs and ewes.

The abdominal cavity usually contains a quantity of clear fluid. In severe cases the liver may appear fatty and pale yellow in colour. Upon opening the fourth stomach the worms will be found in large numbers in the stomach contents and adhering to the stomach wall. It is estimated that the presence of 500 large stomach worms is necssary to produce symptoms of disease, but this will be influenced by the nutrional conditions.

**Treatment.**

*Phenothiazine.* In the treatment of flocks showing evidence of stomach worm infestation the most satisfactory results will be obtained from the administration of phenothiazine. This drug is available in the form of a powder which mixes with water to form a suspension suitable for drenching. Ready-mixed suspensions are also available.

The dose rate will vary according to the age of the sheep under treatment, but for general purposes the following dosage is recommended:—

Grown sheep—
1 lb. phenothiazine per 20 sheep.
Weaners (8-12 months)—
1 lb. phenothiazine per 25 sheep.
Lambs (4-8 months)—
1 lb. phenothiazine per 40 sheep.

In preparing the drench the water should be added to the powder gradually and thoroughly stirred so as to form a creamy suspension. The remainder of the water is then added bringing the mixture up to the strength required for drenching. Before use the mixture should be passed through a fine sieve such as a double thickness of flywire. As an example if it is desired to treat weaners at the rate of 1 lb. of phenothiazine to 25 animals, take 1 lb. of powder and add water, stirring thoroughly until the volume of the mixture reaches 25 fluid ounces. One fluid ounce of this mixture will provide the correct dosage. Similarly in the treatment of grown sheep the volume of the mixture should be brought up to 20 oz. by the addition of water and here again a fluid ounce of the mixture will contain the required dose of the drug.

Phenothiazine suspension may be conveniently administered by means of a single-dose drenching gun capable of delivering a dose of one fluid ounce. Some of the more recent types of automatic drenching guns will also be found suitable. Automatic apparatus fitted with or using the principle of the McMaster Tube enables the administration of phenothiazine cleanly and safely.

Care should be exercised to prevent staining of the wool which may result from drippings from the syringe, from contact of the soiled mouths of drenched sheep with other sheep, and by phenothiazine excreted in the urine, and this may be avoided by rinsing or wiping the nozzle of the syringe after each filling and by releasing the sheep into a large yard immediately they are drenched.

Two drenchings separated by an interval of 14 days are recommended and the treatment may be repeated at intervals of three-four weeks thereafter should this be found necessary. Phenothiazine in the above dosage is also effective against the hair worm and the large-mouthed bowel worm.

In addition to treatment, the flock should be removed from infected pastures, e.g., low-lying areas which remain green and moist in summer and the level of nutrition should be improved by hand feeding or by the provision of good pasture should such be available. Hand feeding should be practised on a generous scale and if possible cereal grains such as wheat, oats or barley should be included in the ration. A rapid improvement in the condition of the sheep may not, however, be expected to occur until green feed becomes abundant. The measures which should be adopted for the prevention of infection are discussed more fully under the heading of "Prevention and control."

## THE HAIRWORM OR BLACK SCOUR WORM
### (Trichostrongylus spp.)

In Western Australia the *Trichostrongylus* or hairworms rank next in economic importance to the large stomach worm. These parasites inhabit the first 15-20 feet of the small intestine. They are pink in colour and are extremely small and slender, measuring from ¼ inch to ½ inch in length. Even when present in very large numbers the parasites, which are difficult to detect, may be overlooked unless a very careful examination is made.

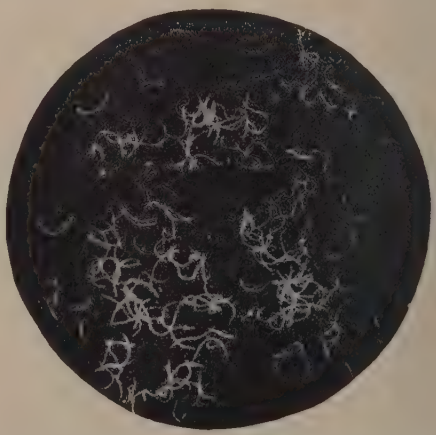

Fig. 5.—HAIRWORM OR BLACK SCOUR WORM (*Trichostrongylus* species)—natural size.
(After F. H. S. Roberts.)

**Symptoms.**

The hairworms are essentially parasites of young sheep. Symptoms are rarely observed in animals over 18 months old. Older sheep which have been exposed to infection as lambs subsequently develop a strong resistance to the parasite. In this State, weaners are principally affected,

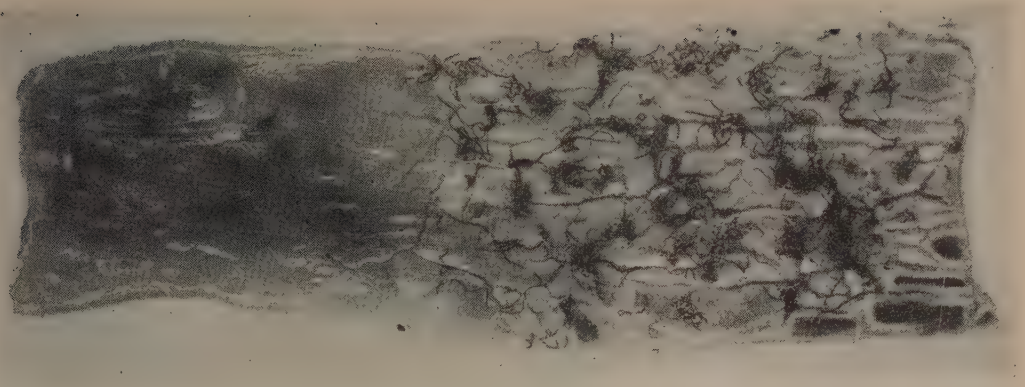

Fig. 6.—A portion of the small intestine of a sheep opened up to show hairworms. A solution of iodine is often used to stain the worms and make them readily visible.

showing symptoms of the infestation during the summer months after the feed has dried off and the nutritional conditions have become poor.

One of the earliest symptoms is loss of appetite. This is not always realised by the stockowner and is, in fact, difficult to detect in grazing sheep. However, careful observation of the behaviour of young sheep may show that they are standing about or wandering aimlessly instead of either grazing, resting and chewing the cud or walking purposefully to feed or water.

Affected animals lose condition, becoming stunted in growth and unthrifty in appearance. As the disease progresses such animals become weak and sluggish and may collapse when driven. A proportion of the animals become affected by diarrhoea, the greenish-black excretions soiling the breech and the hind quarters, this condition being commonly referred to as "black scours." Unless treatment is undertaken heavy mortality may occur. The skin and mucous membranes of the mouth and eyes do not become pale or white in colour as in the case of infestation with the large stomach worm, nor is there any evidence of "bottle jaw." The fact that hairworm infestations are almost exclusively confined to weaners together with symptoms of scouring which rarely occur in sheep infected with stomach worms will further serve to differentiate the two conditions.

**Post Mortem Appearances.**

The carcass is thin and wasted, otherwise there are no very obvious changes. Upon examining the small intestine large numbers of hairworms will be detected. A very careful examination must be made, otherwise the parasites may be overlooked. The first 20 feet of the small intestine should be laid open with scissors and the lining membrane should be closely examined in a good light; preferably in bright sunlight. The intestine should be stretched between the fingers and held up to the light as the examination is made. If difficulty is experienced in detecting the parasites by this method the lining membrane of the intestines should be scraped with a knife and the material thus removed transferred to a shallow glass vessel and shaken with water following upon which the small threadlike worms will be observed floating in its contents.

The worms may be seen readily if stained with a strong solution of iodine, either on the bowel wall or after scraping them off into a glass dish or white enamel tray. Add some strong iodine solution (10 per cent. liquor or tincture from the chemist) and stain for 5-10 minutes. Then add drop by drop a 10 per cent. solution of hypo (sodium thiosulphate) (4 oz. in 1 quart of water) until the iodine colour just disappears. The worms are stained deep brown.

It has been estimated that the presence of at least 10,000 hairworms is necessary in order to produce serious effects. Here

again this will be largely influenced by the nutritional conditions.

**Treatment.**

Affected flocks should be drenched with phenothiazine suspension in the dosage set out in the section on the large stomach worm; this drug being more effective for the expulsion of hairworms than any other preparations at present available. A second drench should be administered after an interval of 14 days and the treatment may, if necessary, be repeated at intervals of three-four weeks thereafter.

In the control of hairworm infestation, adequate nutrition is a matter of great importance. Lambs should be drenched immediately prior to weaning and thence transferred to paddocks carrying the best available feed, these having been reserved for this purpose. Hand feeding should commence early in the summer and continue until the advent of the opening winter rains. This aspect will be discussed more fully under the heading "Prevention and Control."

## THE LARGE-MOUTHED BOWEL WORM
### (Chabertia ovina)

These parasites are found in the coiled portion of the colon ("crown") and on account of their comparatively large size they are unlikely to be over-looked at post mortem. They are stout creamy-white worms measuring about three-quarters of an inch in length and are often found adhering to the bowel wall.

Fif. 7.—LARGE-MOUTHED BOWEL WORM (*Chabertra* ovina)—natural size.
(After Clunies Ross & Gordon.)

The economic importance of this parasite in Western Australia is undoubtedly great. Infestations with the large-mouthed bowel worm commonly occur and they are usually associated with other parasites. Weaners suffering from hairworm infestation may at the same time be found harbouring large numbers of large-mouthed bowel worms. The effects upon the sheep are often considered to be principally due to the former parasite but there can be little doubt that the large-mouthed bowel worm plays a contributory part.

It has, moreover, been shown that the large-mouthed bowel worm is capable of inflicting considerable damage upon the bowel wall which in consequence becomes congested and much thickened. This is accompanied by symptoms of diarrhoea in which the droppings contain much mucus and are streaked with blood, together with retarded growth, weakness and loss of condition.

In field trials carried out in collaboration with the C.S.I.R.O., control of severe infestations with this parasite resulted in increased wool growth and improved wool quality.

**Treatment.**

For the treatment of infested sheep, phenothiazine administered in the dosage and in the manner described for the large stomach worm is the drug of choice.

The compound 1:8 dihydroxyanthraquinone ("Diaquone," "Altan," "Istin") in doses of 2 to 3 grammes is very effective and in cases where large-mouthed bowel worm is the chief cause of symptoms it may be used alone, or it can be combined with phenothiazine to ensure removal of practically all of these worms.

## THE LARGE LUNGWORM
### (Dictyocaulus filaria)

These are long slender creamy-white worms measuring up to four inches in length. They are found in the air passages of the lungs where they will be detected without difficulty at post mortem. Infestations with the large lung worm occur principally in the higher rainfall areas. The effects produced may be serious if the

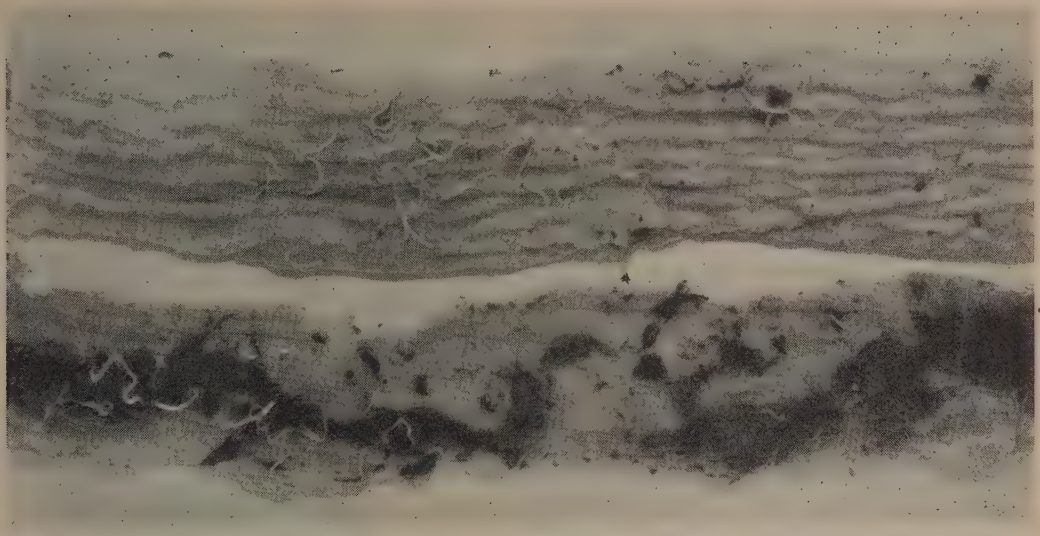

Fig. 8.—Sections of the colon (crown) opened up to show infestation with the large-mouthed bowel worm. This parasite is commonly present in sheep in the South-West of Western Australia. It increases in numbers some weeks after the hairworm or black scour worm.

nutritional conditions are poor and the sheep are at the same time infested with stomach and small intestinal worms.

**Symptoms.**

Young sheep are most frequently affected. Coughing is a prominent symptom and is most evident on the sheep camp at night or after the sheep have been yarded. This is at first the only symptom. In lightly infested sheep the cough is strong and harsh and is not accompained by any loss of condition. In heavily-infested sheep the cough becomes soft and weak and may be altogether absent. The respiration is rapid and shallow. The animal becomes weak and sluggish and loses condition rapidly until death occurs. Suffocation resulting from the complete blockage of the air passages with the parasites is the principal cause of death. Less often pneumonia may be responsible.

**Post Mortem Appearances.**

At post mortem the parasites will be found in large numbers in the air passages of the lungs. In making the examination the trachea (wind pipe) should be split open with scissors and the finer air passages (bronchi and bronchioles) leading into it should in turn be opened. The presence of a large number of worms may result in complete blockage of the smaller air passage, resulting in the collapse of portions of the lung tissues which thus become functionless. These collapsed areas are red in colour and solid and fleshy in consistency. In addition the lungs may contain more or less extensive solid pneumonic areas which contrast sharply with the pale pink, spongy, healthy lung tissues which surround them.

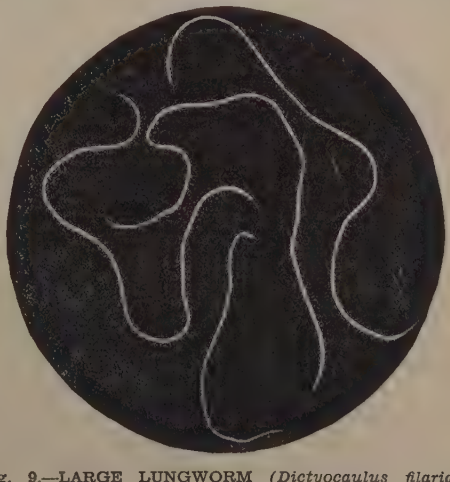

Fig. 9.—LARGE LUNGWORM *(Dictyocaulus filaria)*—natural size.
(After Clunies Ross & Gordon.)

**Treatment.**

In the treatment of affected flocks the most satisfactory results will be obtained by improving the nutritional conditions and at the same time treating the sheep for the removal of stomach and small intestinal worms. In this regard it should be remembered that serious lung worm infestations for the most part occur when feed is scarce and when, in addition, the sheep are infested with stomach and small intestinal worms. Affected flocks should be treated by the administration of phenothiazine drenches. They should be transferred to the best available pastures and the grazing should be supplemented by hand feeding. The removal of stomach and small intestinal worms together with adequate feeding will increase the resistance of the sheep to the lung worm, enabling it to throw of the infestation. After treatment it is important that the flock should be removed from low lying swampy areas in order to prevent reinfection.

In the past, medicinal treatment for the purpose of removing the parasites from the lungs has not proved highly efficient. Various methods of treatment have been employed, including the injection of drugs into the wind pipe or trachea (intratracheal injections) and the inhalation of chloroform or the fumes of burning sulphur while the sheep are confined in a closed chamber. Such methods of treatment are attended by considerable risk. At best they are on partially affected and as they have little or no practical application under field conditions no useful purpose will be served by describing them here.

Recently a new compound, cyanacethydrazide ("Dictycide," "Helmox") has been discovered in England. It is effective when given either by mouth or by injection under the skin.

In the prevention of lung worm infestation, special attention should be given to the protection of lambs and young sheep. Such animals should not be allowed to graze on low lying swampy areas. High, well-drained country should be reserved for them and in addition they should be adequately fed, which will greatly increase their resistance to infection.

The following parasites have also been recorded in this State but they are of little or no importance from an economic point of view. Some of these, while occurring in large numbers, are relatively harmless. In the case of others the infestations which occur are light and consequently produce no serious effects.

**The Small Stomach Worm or Brown Hair Worm (Ostertagia circumcincta).**—These are slender thread-like worms, reddish-brown in colour and about half an inch in length. They occur in the fourth stomach where they will be detected when the lining membrane is carefully examined. The small stomach worm

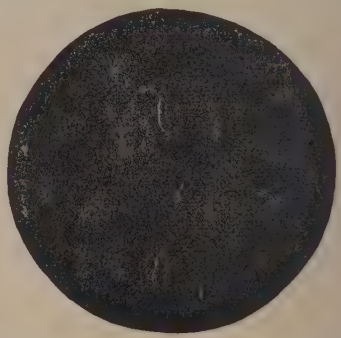

Fig. 10.—SMALL STOMACH WORM OR BROWN HAIR-WORM *(Osterlagia Circumcincta)*—natural size.
(After Clunies Ross & Gordon.)

is a common parasite of sheep in Western Australia. The infestations are usually light or moderate and cause no apparent ill effects. Heavy infestations are stated to cause intermittent scouring, loss of condition and stunted growth in young sheep.

**The Hookworm (Bunostomum trigonocephalum).**—These are large stout reddish-brown worms measuring about one inch in length. They are found in the small intestine and will be distinguished from other worms which inhabit that portion of the digestive tract on account of their relatively large size. Hookworms are rarely met with in sheep in Western Australia and then only in very small numbers. Heavy infestations are capable of producing serious effects, the symptoms being similar to those caused by the large stomach worm.

**The Thin-necked Intestinal Worm (Nematodirus spp.).** — These parasites are found in the small intestine from 10-20 feet behind its junction with the fourth stomach. They are pink or white in colour and from ½ inch to ¾ inch in length. The neck is long, slender, and coiled. Although it commonly occurs in Western Austraila this parasite appears to be of little importance on account of the light infestations which occur. Serious infestations are reported in parts of Eastern Australia, where they produce symptoms of scouring and loss of condition.

**Cooperia spp.**—These are small slender parasites measuring from ¼ inch to ½ inch in length. They occur in the small intestine and will be distinguished from the hairworms because they are somewhat stouter and brighter in colour and are usually coiled. This species is rarely encountered in Western Australia and is no economic importance.

**The Whip Worm (Trichuris spp.).**— These parasites are found in the caecum or blind gut, attaching themselves firmly to the lining membrane. They are white

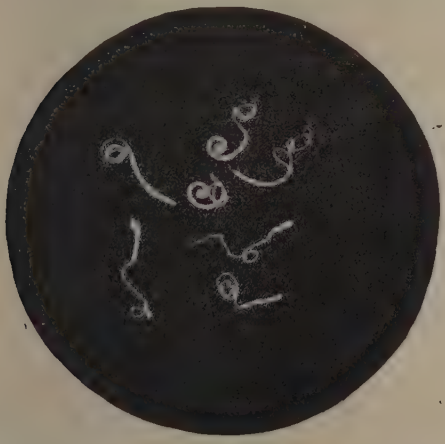

Fig. 11.—WHIP WORM (*Trichuris* species)—natural size.
(After F. H. S. Roberts.)

in colour and about 3 inches in length. The head end of the parasite is long and slender and the body by comparision short and stout—hence the popular name "whip worm." Even when present in large numbers these parasites appear to cause no ill effects.

**Oesophagostomum venulosum.** — This parasite has been recorded only in the higher rainfall districts of the South-West. It is a stout, whitish worm about ½ inch in length and is found in the caecum or blind gut. It is a relatively harmless parasite producing no ill effects upon the animal.

**The Small Lung Worm (Muellerius capillaris).**—The presence of this parasite is indicated by the occurrence of shot-like nodules in the lung tissues. The worm itself, which inhabits the finest air passages and is small in size, is rarely detected. The small lung worm is apparently harmless. Heavily infested sheep show no evidence of ill-health.

**The Sheep Tapeworm (Moniezia spp.).** —The tapeworms are found in the small intestine. They are flat ribbon-like worms measuring up to 18 feet in length and half an inch in breadth, creamy-white in colour and segmented. The head of the parasite is extremely small; the body increases in width from the head backwards. In heavy infestations the white segments which are passed out by the sheep may be observed in the droppings. Despite their large size, the tapeworms do not usually produce any serious effects. Lambs under six months old, upon becoming heavily infested, may show evidence of stunted growth and unthriftiness accompanied by diarrhoea or constipation. In the case of older sheep the parasite is harmless. Bluestone-nicotine drenches are very effective for the removal of this parasite.

## LIFE HISTORY

A knowledge of the life history of the parasites is an essential to the application of control measures. The life cycles of the stomach and intestinal worms are in general similar. The female worms which are present in the digestive tract of the sheep produce large numbers of eggs which are passed out with the droppings and infect the pastures. Some species are prolific egg layers. A female *Haemonchus contortus* (large stomach worm) may produce 5,000-10,000 eggs daily. Within a few days the eggs hatch into larvae which, under favourable conditions of temperature and moisture, continue to grow and develop reaching the infective stage after a further interval of four-six days. In-

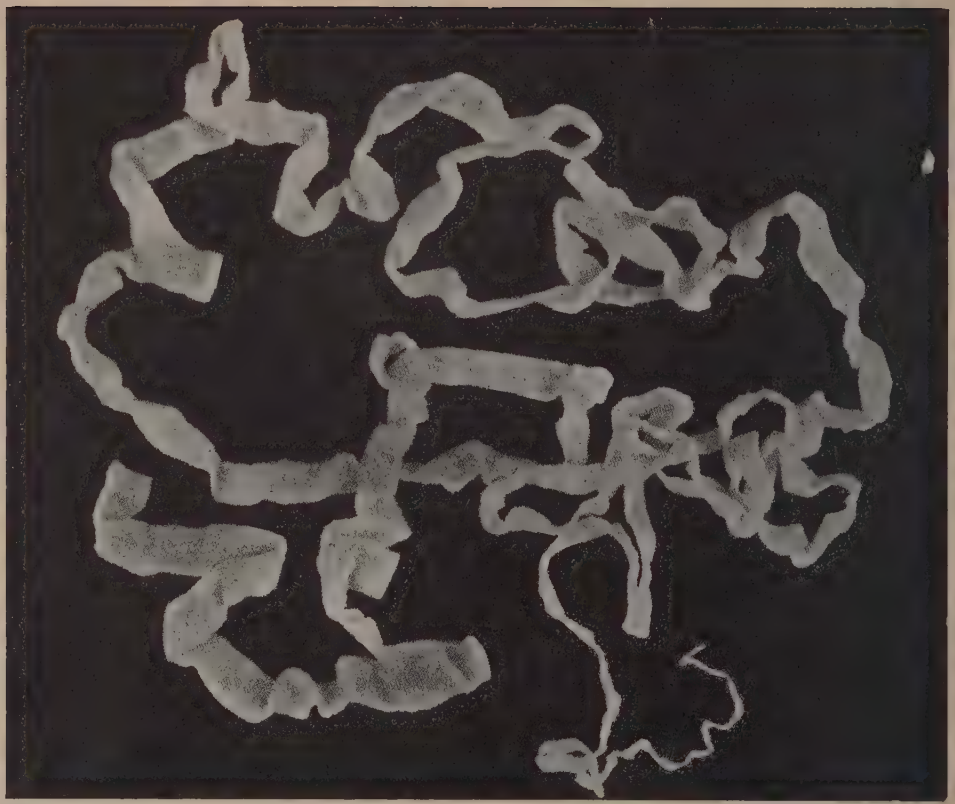

Fig. 12.—SHEEP TAPEWORM (*Moniezia* species)—natural size.
(After F. H. S. Roberts.)

fective larvae crawl up the blades of grass or herbage and are swallowed by the sheep while grazing. Upon reaching the digestive tract they develop to maturity. The infective larvae are active when the pasture is wet with rain or dew, ascending in the evening and descending in the morning. In dull rainy weather they may remain on the pasture during the whole of the day, considerably increasing the risk of infection.

The infective larvae are enclosed in sheaths and are consequently very resistant to heat and dryness, which enables them to survive on the pasture for several weeks under summer conditions. Before reaching the infective stage, larvae show little resistance to such conditions and do not survive very long. The eggs of some species such as the *Trichostrongyles* (hair-worms) are highly resistant and may survive for some months.

In the case of the large lung worm, the eggs are laid in the air passages of the lungs, are coughed up into the pharynx (throat) and are swallowed. In the intestine they hatch into larvae which are passed out in the droppings. On reaching the outside world the larvae continue to develop and pass on to the infective stage. Infective larvae show little tendency to migrate upwards on the pasture, but are able to survive for long periods (up to nine months) in shallow water where they are swallowed by sheep when drinking or grazing over marshy areas. Upon reaching the intestine, the larvae burrow into its wall and enter the lymph vessels by which means they are carried to the lungs, where they grow to maturity.

In the case of the tapeworms, segments containing the eggs are passed out with droppings and are consumed by an earth mite in which they hatch into larvae.

Fig. 13.—These two sheep illustrate the advantages of well-applied worm control measures. The sheep in the rear is one of a group drenched four times with phenothiazine during a period of 15 months. The sheep in front is typical of a similar group that were not drenched. Note the difference in condition. The drenched group averaged 89.5 lb. liveweight and cut an average of 11 lb. 5 oz. of wool per sheep. The undrenched group weighed only 77 lb. and cut 9 lb. 1 oz. of wool.

These mites are swallowed by sheep while grazing and the larvae which they contain are by this means transported to the small intestine where they develop into adult tapeworms.

Fig. 14.—Drenching with an automatic drenching gun which incorporates an oesophageal tube. A narrow race is desirable and small sheep or lambs which can be restrained easily may be approached from behind. Large sheep are best approached from the front.

## PREVENTION AND CONTROL

In the control of worm infestation reliance should not be placed upon drenching alone. Other control measures are available which, when combined with drenching and thoroughly applied, are capable of greatly reducing the degree of infestation. The measures which may be adopted are described hereunder. While they may not be fully applicable in all cases they should as far as possible be adapted to meet the particular conditions which obtain.

**Drenching.**—The drenching of flocks is an important feature of any programme of worm control, but as this involves the flock owner to outlay for materials and labour it is essential that the work should be carefully planned to give the best possible results.

As a result of experimental work carried out in this State by the C.S.I.R.O. and the Department of Agriculture, we now have a reasonably accurate picture of the seasonal trends in worm infestation—when the worm burdens are likely to rise or decline, when they are highest and when they are at their lowest levels.

This gives a good indication of the times when drenching is likely to be most effective. (See Fig. 15.)

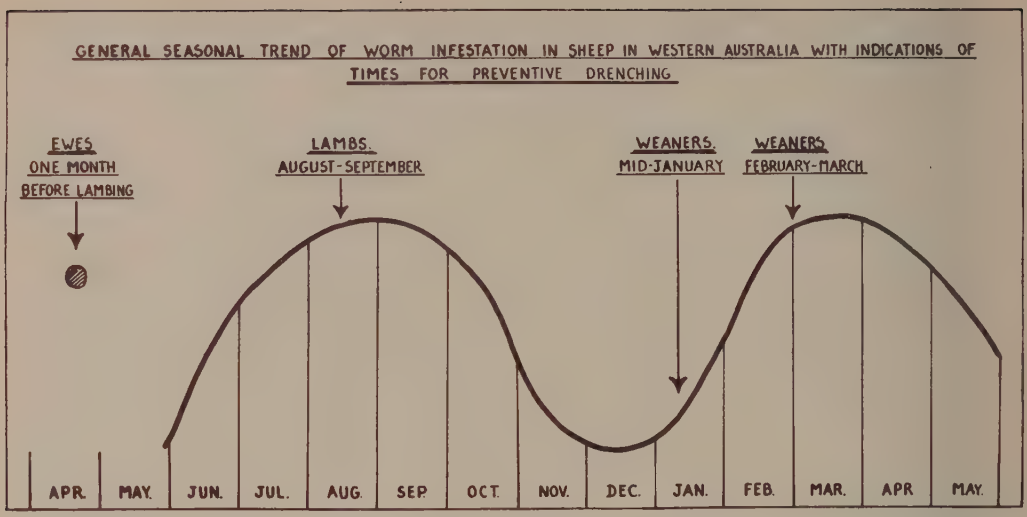


Fig. 15.—Diagram showing when worm infestation is likely to be severe in this State, and when drenches are likely to be most effective.

Lambs on contaminated pastures pick up worm larvae as soon as they commence to graze and, in order that they should receive a reasonably worm-free start in life, it is recommended that the ewes should be drenched about a month prior to lambing.

With the approach of warm, moist weather, the worm infestation increases and lambs should be drenched in August-September to rid them of heavy worm burdens. At this time, the ill-effects of the heavy infestation may not be obvious, but they would become apparent as the feed dries off and becomes less nutritious during the summer months.

By drenching the weaners in mid-January, the worm burdens are again reduced and the pastures are not heavily contaminated when the seasonal "break" occurs in the autumn.

A further drenching in February-March tides the weaners over the build-up of worm burdens which usually occurs at this period.

These drenching times apply, in the main, to districts with annual rainfalls of 15 inches or more. In the drier districts, the rountine treatments may be reduced to the August-September and mid-January drenchings but where wet years are encountered it would pay to follow the programme described for the wetter districts.

Phenothiazine drenches should be employed as this drug is highly effective against both stomach and intestinal worms. The removal of these parasites increases the resistance of the sheep to lung worm infestation.

A planned drenching programme, in combination with the other measures described here, will help to prevent worm infestation. There is an understandable reluctance on the part of many flock-owners to drench sheep and lambs which are apparently thriving but **it should always be remembered that when the animals are showing obvious signs of worm infestation, it is already too late to obtain the full benefit from treatment.**

**Nutrition.**—Good feeding will enable the sheep to resist worm infestation and is no less important than systematic drenching as a control measure. Improved pastures should be provided, clover being especially valuable in this respect. Hand feeding should be practised during the summer months. Whenever possible, grain such as oats, wheat or barley should be incorporated in the ration at the rate of $\frac{1}{4}$-$\frac{1}{2}$ lb. per head daily. Adequate feeding

is of special importance in the case of young sheep, and partciularly so for the control of hairworm infestation in weaners against which parasite drenching is only partially effective.

**Rotation and Spelling of Pastures.**—If a paddock is left unstocked with sheep for a month or longer, large numbers of the worm larvae infesting the pastures will die out. Although the more resistant forms are able to survive for long periods, the spelling of pastures in this manner will enormously reduce the degree of infestation. The hot dry conditions of summer are particularly effective in bringing this result about. Consequently if a system of rotation is practised whereby sheep are regularly moved to paddocks which have been spelled for not less than a month, the risk of worm infestation will be greatly reduced.

Burning off at the end of summer will also assist in freeing the pastures of worm eggs and larvae. Pastures which have been spelled or burned off should be reserved for the reception of lambing ewes and weaners.

**Avoid Low Lying Marshy Areas.**—Moist and marshy areas which remain green during summer are especially dangerous. Sheep congregate on such areas in large numbers and as a consequence the pasture becomes heavily contaminated with worm eggs and larvae. Further contamination may result from drainage from surrounding hills. The moisture which is present favours the development of eggs and larvae and the close grazing resulting from the heavy stocking further increases the risk of infestation. Similarly swamps containing shallow water which favours the development and survival of lung worm larvae should also be avoided. Such low lying and swampy areas should be fenced and provision should be made for watering from troughs.

**Avoid Overstocking.**—Overstocking will lead to heavy contamination of the pastures and the resultant close grazing will ensure that large numbers of infective larvae are consumed by the sheep. When the provision of improved pastures results in high carrying capacity, the increased risk of worm infestation may be offset by the adoption of a system of rotation and spelling of pastures.

**Protection of Lambing Ewes and Weaners.**—These animals are the most susceptible and special precaution should be taken for their protection. Ewes should be drenched shortly before lambing and then transferred to paddocks which have been spelled for a month or longer, or which have been burned off. Lambs should be drenched at the time of weaning and then transferred to paddocks which have been spelled for a similar period, and which are carrying good feed.

Paddocks intended for the reception of weaners should be closed up towards the end of winter, which will enable the above requirements to be fulfilled. In addition, lambs and young sheep should not be allowed access to marshy or swampy areas. Hand feeding should be practised during the summer. In the case of weaners it should commence early (December or January), which will enable the animals to accustom themselves to the feeders and will ensure that they do not suffer a set-back later on. The importance of adequate nutrition in the case of weaners cannot be over-emphasised. In the control and prevention of hairworm infestation it is the first line of defence.

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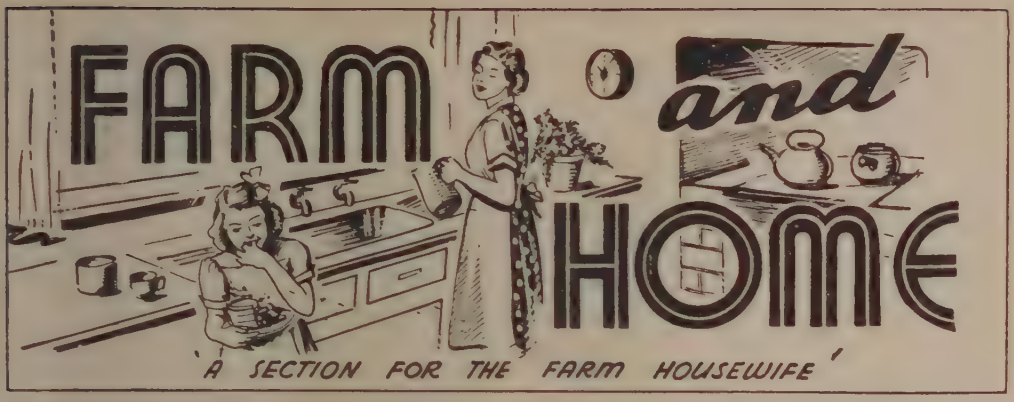



# "A Happy Christmas Everybody"

By MARGARET SPENCER

**WITH Christmas almost upon us are you one of those with everything under control so that you feel relaxed and happy? Or are you one of the majority, still with presents to buy, cakes to make, holidays to arrange and finding it hard to believe that December 25 is really so close? There are so many bazaars, parties, unexpected callers and so on just before Christmas that we know we have to get organised early if we are not to spoil our enjoyment of a very happy time by having a wild rush at the end.**

Our preparations made well in advance can leave us free to hang out a really big welcome sign and to have leisure to enjoy the spirit of goodwill that prevails at this time of the year. Catering for fluctuating numbers can be a problem but if you possess a home freezer you will almost certainly be making good use of it this year with poultry, hams, sweets and even vegetables prepared well in advance.

The puddings, mincemeat and cakes that are so much a part of Christmas are usually made early. Traditionally, mincemeat is made 8 weeks before, to allow its flavour to develop but just in case yours is not made yet a couple of recipes are included in this issue. If you are not keen on the suet which is normally included, try the fruit mince without it. It is not quite so rich, is delicious and incidentally does not need so long standing before use.

Even if this year's plum pudding is already made, the recipe given is well worth a place in your recipe file for next year's use. It's a very old English one and if you've a family that in spite of our warm climate likes to keep the traditional pudding on the Christmas dinner menu, you'll love it with brandy sauce, hard sauce or ice-cream.

**MINCEMEAT (Traditional Recipe)**

¾ lb. finely chopped beef suet.
¾ lb. chopped raisins.
1 lb. currants.
1 lb. chopped apples.
4 oz. chopped peel.
½ teaspoon mixed mace and cinnamon.
½ level teaspoon ground cloves.
¾ lb. castor sugar.
½ level teaspoon salt.
Grated rind and juice of 1½ lemons.
½ gill brandy.
½ gill port wine.

Mix thoroughly and seal in jars till needed. (Keep in a cool place.)

### FRUIT MINCE (Without Suet)

1½ lb. currants.
¼ lb. sultanas.
¼ lb. finely chopped peel.
Juice and zest of 1 lemon.
½ oz. spice.
1 lb. sugar.
¾ lb. chopped apples.
1½ tablespoons rum.

Mix well and seal in jars. Store in a cool place, refrigerator if for long periods.

### PLUM PUDDING

**Ingredients.**

½ lb. beef suet.
½ lb. raisins.
½ lb. currants.
½ lb. sultanas.
¼ lb. mixed peel.
4 oz. chopped apple.
4 oz. soft breadcrumbs.
4 oz. plain flour.
1 lemon (zest only).
½ lb. sugar.
4 eggs.
2 oz. almonds.
1 gill of milk.
1 wineglass brandy or rum.
½ a grated nutmeg.
¼ teaspoon salt.

**Method.**

(1) Mince suet.
(2) Wash and dry fruit. Blanch almonds, cut in 2 or 3 pieces.
(3) Rub suet and flour together. Add crumbs, salt, fruit, sugar, nutmeg, almonds, lemon rind. Mix well.
(4) Beat eggs, stir in the milk and brandy, then add to flour fruit, etc. Mix very thoroughly.
(5) Cook in a greased basin, covering with a greased paper and pudding cloth, or in a scalded and floured pudding cloth. Put into boiling water and boil 5 to 6 hours.
(6) On day of serving cook for at least 1 hour more.

### CHRISTMAS GIVING

The thought and care that go into a home-made Christmas gift make is priceless to the recipient and there are many ways in which you can use your sewing and culinary skill to help your gift budget. Where will you find a little miss who won't love some new additions to her doll's wardrobe? The scrap-bag can furnish the material and the makers of your own dress patterns, the patterns you need. The little miss herself will love some shortee 'jamas like big sisters and sewing baskets, beach bags, etc., are quickly and easily made. And if dad or big brother go in for home-carpentry they will appreciate a carpenter's apron with big divided pockets for tools, notebook, screws and a small one at the top for that pencil which is always disappearing. Denim or sail cloth are serviceable materials for the job. Only find the time and you can save a lot of money with your needle.

In the kitchen too you can produce gifts that please. Home made sweets and biscuits can be packed in the plastic refrigerator dish, or the shiny cake tin you are giving, or empty stocking boxes can be covered with coloured paper packed with sweets (some of them in "silver" paper perhaps) and with celophane over the top an attractive bow or piece of holly you have an attractive gift. The celluloid box that once held your new powder puffs or some glamour undies, can be pressed into service as a gift box. Remember that the packaging can make a wealth of difference. Some quick and easy recipes and ideas for variations are given. Your recipe books will yield you many more. If you have a favourite recipe why not use it and include a copy when packing your gift? There is no need to stop at sweets and biscuits either. Jams, pickles, lemon butter, etc., bottled in those pretty but inexpensive glass tumblers which are so handy when the crowd drops in will look attractive and are practical too.

### BISCUITS

From any good rich biscuit dough you can make a variety of biscuits with plain or fancy cutters or a biscuit forcer and a few trimmings. Star or bell shapes are in keeping with the Christmas theme but if you have no fancy cutters crescent shapes and wreath shapes can be cut with plain cutters. Ice your ring (wreath) with plain white icing and pipe a simple bow. or spray of flowers on one side to add a gay note.

Coloured sugar can be sprinkled on some, while cherries, almonds, walnuts, silver cachous can be used on others.

An attractive shape can be made by cutting thinly rolled biscuit dough into 2½in. squares and with these on a cold greased tray cut in 1in. from the corners towards the centre. Fold alternate corners into the centre, press lightly and add a glace cherry and touch of angelica to garnish.

Almond fingers, made by spreading a plain biscuit dough in which the egg yolk only is used, with stiffly beaten egg white mixed with 4 oz. of sifted icing sugar, sprinkling with chopped almonds and cutting into finger lengths are baked in a moderate oven for 10-15 minutes.

Cheese straws are popular, and some variety can be added by cutting a few rings, and by twisting some of the straws together in pairs. The same recipe can be used to cut a variety of small shapes to be used as bases for savouries to be spread or piped with savoury butter when required and garnished with parsley, salted peanuts, red peppers, stuffed olives, radish, etc. A supply of these biscuits in your own tins are always handy.

### CHEESE STRAWS

**Ingredients.**

6 oz. plain flour.
Salt and cayenne pepper.
1 egg yolk.
3 oz. butter or margarine.
4 oz. grated cheese.
A little water.

**Method.**

(1) Sift flour, salt and cayenne.
(2) Rub in the shortening.
(3) Add the grated cheese and mix well.
(4) Beat the egg yolk with about 1 tablespoon cold water and mix to a rather stiff paste.
(5) Knead on lightly floured board.
(6) Roll into a strip about 4in. wide.
(7) Cut into narrow straws. Cut a few rings for serving straws in bundles.
(8) Bake in a moderately hot oven (425°F) until firm and golden brown.

**Handy tip** for rolling biscuit dough or pastry—If you have trouble with dough sticking or crumbling roll between two sheets of greaseproof paper or plastic.

### CHEESIES

**Ingredients.**

3 oz. plain flour, 1 oz. S.R. flour, or all plain flour may be used.
4 oz. grated cheese.
4 oz. butter or margarine.
Salt and cayenne pepper.
Coconut.

**Method.**

(1) Sift flour, salt and cayenne.
(2) Rub in the fat.
(3) Add the cheese and work together to form a firm dough. Do not let mixture become oily. Chill if necessary.
(4) Roll into small balls between floured hands.
(5) Coat with coconut and flatten slightly.
(6) Bake in a moderately hot oven till a very light golden brown.

### SWEETS

The true fondant is made by sugar boiling but a handy uncooked fondant can be quickly made and owing to its versatility and ease of use one receipe for it is given here. Once prepared a variety of flavours can be added, melted cooking chocolate being one, peppermint another. Colourings can be kneaded into the mixture or in the case of fondant "apples" and bananas, etc., can be painted on with a fine camel hair paint brush dipped in food colour or to give the brown streaks, blended cocoa. The rind of an orange can be simulated by rolling little round balls of orange flavoured and coloured fondant on a nutmeg grater and a clove can be pushed into one end of an "apple." Dates can be stuffed with fondant, or a half walnut may be pressed in to a ball of fondant, two colours may be rolled out thinly then placed one on top of the other, rolled firmly and cut into slices or blocks. Some may be rolled in coloured coconut or topped with a silver cachou, while into a ball of peppermint flavoured fondant, a chocolate bit may be pressed point first, giving a button like appearance and an interesting combination of flavours.

Apart from the fondants, marshmallows, fudges, coconut ices and toffees are popular but it is best to pack these separately or at least in individual wraps if put in one box.

### UNCOOKED FONDANT

**Ingredients.**

1 lb. sifted icing sugar.
2 oz. glucose.
1 egg white.
2 teaspoons lemon juice.
Vanilla (a flavouring and colouring required).

**Method.**

(1) Heat glucose till liquid by putting it in a cup and standing in boiling water.

(2) Break up egg white with fork but do not beat.

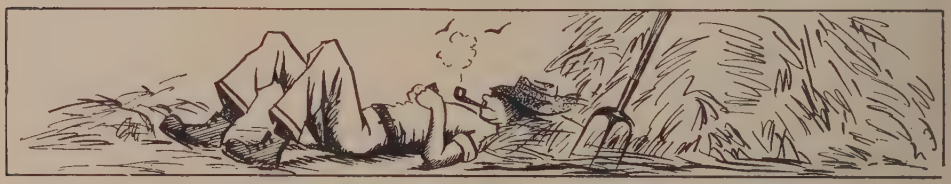
(3) Make a well in centre of icing sugar and pour glucose, egg white and lemon juice into it.

(4) Gradually work the icing sugar into the middle, using a wooden spoon, till it is nearly combined, then knead.

(5) Turn on to a board dusted with sifted icing sugar and knead thoroughly for at least 5 minutes. Thorough kneading is essential to a smooth creamy result. Flavourings and colourings are kneaded into the mixture.

(6) The fondant not in actual use should be wrapped in greaseproof paper then a damp cloth.

(7) After shaping allow sweets to "set" on waxed paper.



# PEDIGREE SEED

## WHEAT, OATS AND BARLEY

**THE Minister for Agriculture (the Hon. E. K. Hoar, M.L.A.), has advised that supplies of pedigree seed wheat, oats and barley will be available for distribution from the forthcoming harvest at the Department's Research Stations.**

Varieties available this season are:—

### Wheat

*Midseason*: Baroota Wonder (hay variety), Bencubbin, Bencubbin 48 (rust resistant), Eureka, Kondut.
*Early*: Gabo (rust resistant), Wongoondy (rust resistant), Insignia 49 (rust resistant).
*Very Early*: Bungulla.

### Oats

*Late*: Algerian.
*Midseason:* Avon, Dale.
*Early:* Ballidu, Kent.

### Barley

Atlas, Beecher, Prior.

Prices per bag of three bushels inclusive of rail freight to farmer's siding will be:—Wheat, 60s.; oats, 40s.; barley, 55s.

Prompt attention to orders will be ensured if the following directions are observed by intending applicants.

(1) Make early application direct to the Department of Agriculture, St. George's Terrace, Perth.

(2) Give clearly full name, postal address, and siding to which the seed is to be railed.

(3) As soon as possible after receipt of account, remittance should be forwarded. Statements are sent out in order of receipt of the application. No definite reservations can be made until the seed is paid for.

*A Guide*

# To the Harvesting of Plums for Export

By F. MELVILLE, Senior Adviser (Fruit)
and
J. S. BLOOMFIELD, Senior Packing Instructor

**WESTERN AUSTRALIA is well situated geographically to supply the demand for plums on the Singapore market and over the past 10 years, a substantial export trade has been developed. Growers have found this outlet profitable, and increased plantings of suitable varieties have been made. During the 1957 season—a record export year—almost 40,000 boxes were shipped.**

The export of plums is very different from local marketing in that the fruit must undergo a period of cold storage prior to and during transit, and several weeks may elapse before it reaches the consumer. Plums picked when immature will fail to ripen properly after storage, whereas forward fruit may break down in transit. This necessitates careful selection at picking time to ensure that the plums are at the best stage for handling. To assist growers in this regard, the accompanying colour plates have been prepared depicting the various stages of ripening of two of the main export varieties, namely Narrabeen and Wickson. For each variety, eight stages are shown ranging from immature (No. 1) to ripe (No. 8.)

## NARRABEEN

In assessing the maturity of the Narrabeen variety, firmness and ground colour are the main points to be considered. The red colour is not a good guide to maturity. Plums on the exposed portion of the tree can be red and yet too immature for harvest, whereas those in the sheltered part may fail to develop any degree of redness until too ripe for export. Fruit from trees of declining vigour will also develop more red colour than vigorous young trees.

In referring to the accompanying plate, the emphasis should therefore be on changes in the ground colour rather than red. The ideal stages are 4 and 5 and as far as possible picking should be confined to this type of fruit. Stage 3 may be included only if the fruit is showing signs of losing its immature hardness or, as it is often termed, developing some "give." Care must be taken in including Stage 5 that no softening has taken place. In the Narrabeen, softening commences around the stem end.

## WICKSON

During ripening, the Wickson plum undergoes a series of colour changes which may be used as a positive guide in assessing maturity. Ripening takes place by a gradual diffusion of yellow into the green ground-colour commencing at the tip, spreading along the suture and finally extending to the whole fruit. As this change proceeds, a red colouration appears on the tip of the plum and gradually spreads until the ripe plum is completely red.

The optimum export picking maturity is depicted by Stage 4 in the accompanying plate. Fruit to comply with this stage of maturity should have developed a definite break in the ground-colour but still retain a considerable amount of green.

## NARRABEEN—Stages of Ripening

1.—Hard, green; 2.—Tinge of yellow on suture; 3.—Diffusion of yellow over half the fruit—slight give; 4.—Yellowish green—slight blush; 5.—Yellowish green—increased red blush; 6.—Yellow with green tinge—red blush; 7.—Yellow—full blush—some softening; 8.—Red—ripe

## WICKSON—Stages of Ripening

1.—Hard, green; 2.—Slight tip yellowing; 3.—Extension of yellowing along suture; 4.—General break in the ground colour; 5.—Yellowish green with yellow rib; 6.—Red tip; 7.—Half red; 8.—Full red

Stage 5 shows the development of yellow along the rib of the plum while the rest of the fruit is still largely green. This stage may be included, provided the fruit is being cool stored promptly. There should be no signs whatsoever of a red tip. Where undue delay in placing the fruit in cool store is likely, due for instance to distance of transport, or when weather conditions are unfavourable during the packing period, it is preferable to pick closer to Stage 3.

The plates for both Narrabeen and Wickson plums have been prepared as a guide to growers of export plums on the basis of experimental trials conducted over a number of years. It must be emphasised however, that if satisfactory results are to be achieved, there must be a minimum of delay from the time the fruit is picked until it is packed and delivered to the cool store. During handling operations the fruit should be kept as cool as possible.

In both the Narrabeen and Wickson varieties bleaching and yellowing of surfaces exposed to the sun may occur particularly on trees with limited foliage. This change in colour must not be confused with colour changes due to ripening.

# INSECT Pests AND THEIR CONTROL

By C. F. H. JENKINS, M.A., Government Entomologist

# STORED-GRAIN PESTS

**STORED foodstuffs such as grain, dried fruits and flour are constantly liable to the attacks of insect pests, with the result that the farmer, grain merchant, miller and grocer have a continual war to wage in order to keep their products in a wholesome condition. During the 1914-18 World War, millions of bushels of bagged wheat were stored in Australia on account of the lack of shipping space, and incalculable damage was done by mice and "weevil" attack. When there is a possibility that stocks of grain are to be stored, precautions must be taken to protect it from rodent and insect damage.**

Before dealing with the methods which may be adopted to safeguard the grain, it will be well to know the names of the insects with which we are concerned, how they may be recognised and the way in which they affect the wheat.

Grain insects may be divided into two main groups which can be listed as follows:—

**Primary Insects.**—Those capable of affecting sound grain—

- Rice weevil (*Calandra oryzae* L.).
- Granary weevil (*C. granaria* L.).
- Lesser grain borer (*Rhizopertha dominica* Fabr.).
- Angoumois grain moth (*Sitotroga cerealella* Oliv.).

**Secondary Insects.**—Those incapable of attacking sound grain—

- Confused flour beetle (*Tribolium confusum* Jacq.-Duv.).
- Rust-red flour beetle (*T. castaneum* Herbst.).
- Saw toothed grain beetle (*Oryzaephilus surinamensis* L.).
- Flat grain beetle (*Laemophloeus* spp.).

There is a belief prevalent even in these times that "weevils" appear spontaneously in grain just as toads were believed by the ancients to be the product of mud and slime, and flies an inevitable sequel to filth. That there is absolutely no foundation for this will be seen from the life history details which follow. Clean wheat will remain free from insect attack indefinitely if no outside infection is permitted. Every "weevil" is derived from an egg laid by a female and there is definitely nothing spontaneous or mysterious about an outbreak, however obscure the source of infestation may be.

## PRIMARY PESTS

### Rice Weevil

(*Calandra oryzae* L.).

Sometimes known as the black weevil, this insect varies considerably in size, but seldom exceeds one-eighth of an inch in length. The size is readily gauged from a comparison with a wheat grain in the accompanying illustration.

Being a true weevil the head is produced into a long snout at the end of which the mouth parts are borne. The colour varies

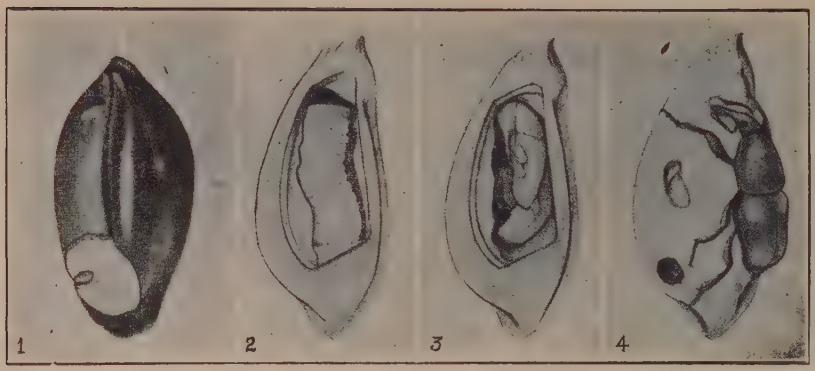



Fig. 1.—Life stages of rice weevil in wheat. 1.—Grain dissected to show egg; 2.—Well grown larva; 3.—Pupa; 4.—Adult feeding upon kernel. Note in 4 the hole in lower portion of kernel made by the adult on leaving the seed. The other shallower holes were made by the adult in feeding after emergence (From U.S. Dept. Agric.).

from reddish brown to almost black and usually four light-coloured spots are distinguishable on the back. The thorax is densely pitted with round punctures.

Beneath the wing covers are a pair of fully developed wings and although the insect is seldom seen in flight, it is quite capable of adopting this method of progression.

In some countries indeed these weevils fly from the barns into the fields and attack standing grain, but careful observations have failed to reveal any such tendencies in this State and it is considered that summer conditions are unsuitable for the field activity of this insect.

The adult weevil can live for a considerable period, published figures varying from four to eight months, and during this time 300 to 1,000 eggs may be laid.

Before laying her eggs, the female bores a small hole with her mandibles into the wheat grain and therein deposits an egg. This is then covered with a gelatinous fluid which entirely plugs the hole. The fat, legless grub which emerges after three or four days feeds in the grain for about a fortnight and then pupates to emerge as an adult weevil at the end of about a week. It will be seen, therefore, that from egg to adult occupies from three weeks to a month. This time varies greatly according to temperature and humidity, and under cool conditions would be greatly increased. Below an average temperature of 50°F. weevil activity is considerably checked, but in this State the mean monthly temperature falls below 50°F. in but a few districts and then for only a short period. Weevils when working in wheat themselves tend to raise its temperature so that our winter conditions cannot be regarded as a serious check upon the pest.

**Granary Weevil**
(*Calandra granaria* L.).

The granary weevil is reddish brown to black in colour, and about the same size as the rice weevil from which it may be distinguished by the lack of the light spots on the wing covers and the presence of elongated instead of circular punctures on the thorax. Another important difference is the absence of flight wings.

As in the case of the rice weevil, the adults and grubs feed voraciously on grain, and the life history and habits of the two are so similar as to require little further comment.

The grain weevil, although usually associated with the rice weevil, prefers a temperate climate and considerable damage is not experienced locally from this species with the possible exception of some of the extreme southern regions.

**The Lesser Grain Borer**
(*Rhizopertha dominica* Fabr.).

The lesser grain borer is not a true weevil, but belongs to the same group as many of the timber borers (*Bostrichidae*). It is one of the smallest grain pests, but one of the most serious in this country.

During World War I, many shipments of Australian wheat were heavily infested by this beetle and it became known abroad as the Australian wheat weevil, although its native home is probably India. It is cylindrical in shape, dark brown or black, and about one-eighth of an inch in length.

Both the adults and the larvae are responsible for serious damage to a variety of grains. The beetles may live for a period

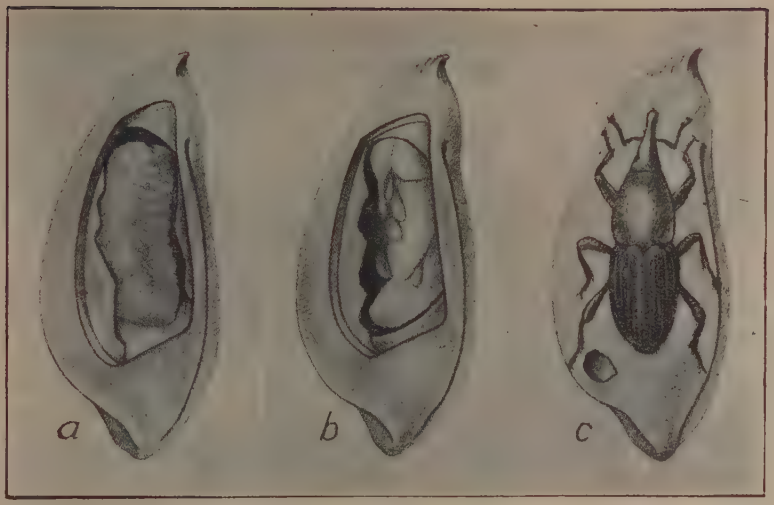



Fig. 2.—Life stages of granary weevil in wheat. a.—Well-grown larva; b.—Pupa; c.—Adult. (From U.S. Dept. Agric.).

of up to four months and during that period lay 300 to 500 eggs. The eggs are laid singly or in clusters in the loose grain, and the young lavæ feed upon any floury material present or bore into grain damaged by the attack of the parents. They are generally incapable of entering a sound grain. From egg to adult is said to occupy about a month under favourable conditions, but may be extended to several months.

This pest is now widely distributed in Western Australia, having been first recorded at Fremantle in about 1916. The Geraldton zone was the first country area to be widely affected, but in recent years many other districts have reported the pest.

**The Angoumois Grain Moth**
(*Sitotroga cerealella* Oliv.).

The Angoumois grain moth is buff or yellowish brown in colour with a wing spread of about half an inch. It is sometimes found infesting old hay stacks and is parasitised by the hay itch mite (*Pediculoides ventricosus*) which sometimes produces an annoying irritation during the process of chaff cutting.

Like the rice weevil, this moth is known in some countries to fly into the field to infest the standing grain, but so far no

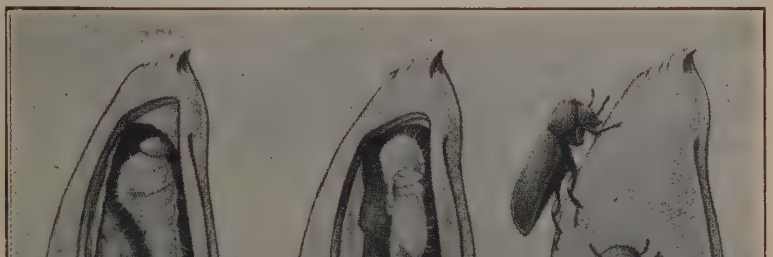



Fig. 3.—Life stages of the lesser grain borer. a.—Well-grown larva; b.—Pupa; c.—Two adults (From U.S. Dept. Agric.).

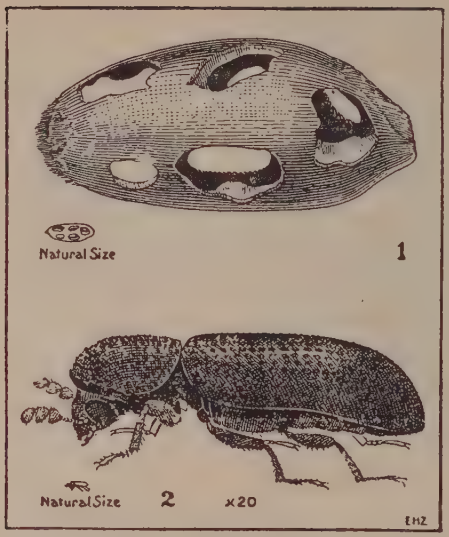



Fig. 4.—1.—Grain of wheat attacked by the lesser grain borer. 2.—The lesser grain borer
(From Ag. Gaz., N.S.W.)

proof of this habit has been received locally, and we can confine our attentions to the insect as a pest in store.

An average of 40 or 50 eggs are laid by the female, but sometimes as many as 250-300 may be deposited. They are laid on or near the grain and the tiny grub on hatching bores into the kernel, often spinning a small cocoon at the entrance. When fully fed it eats out a channel to the seed coat, but leaves a small portion intact which is later pushed off as a lid when, after the pupal stage spent in a silken cocoon within the grain, the adult moth finally emerges. From egg to adult occupies about five weeks but again development is greatly slowed down under cold conditions, although the moth is said to be capable of working at lower temperatures than the weevils.

## SECONDARY PESTS

### Confused Flour Beetle
(*Tribolium confusum* Jacq. Duv.).

The confused flour beetle is a rather elongated shiny reddish brown beetle about one-seventh of an inch in length. The head and thorax are densely pitted and the wing covers ridged lengthwise with punctures sparsely distributed between the ridges.

Like the other storage pests mentioned it is not native to Australia but has been widely distributed by commerce and may be found attacking farinaceous materials in all parts of the world. It is principally a pest in flour mills, being incapable of feeding upon sound grain, but it will attack broken grains and kernels damaged by weevils and consequently helps in the final destruction of stored wheat.

The average life of a beetle is said to be 12 months or more, and females may lay over 400 eggs. These are deposited loosely, and being covered with a sticky secretion become covered with flour or grain dust and readily cling to the sides of bags and other receptacles so that clean material placed in them can rapidly be infested. In five to 12 days the eggs hatch into small grubs about 3/16ths of an inch long and resembling tiny wireworms. These pupate as naked yellowish-white pupæ and about six weeks after the egg was laid the adult beetle emerges. As with the other insects mentioned, this life cycle may be greatly prolonged by adverse conditions.

### Rust-Red Flour Beetle
(*T. castaneum* (Herbst)).

The rust-red flour beetle cannot be distinguished from the foregoing species without a magnifying glass, but whereas the antennæ of the confused flour beetle increase gradually in size towards the tip, those of the rust-red species increase abruptly at the tip, giving them a clubbed appearance. In addition, as can be seen from the accompanying illustrations, the sides of the head of the confused flour beetle are expanded and notched at the eyes whereas in this species the sides of the head are nearly continuous at the eyes.

The habits and life history of this species resemble very closely those of the confused beetle and so need not be further detailed.

### The Saw-Toothed Grain Beetle
(*Oryzæphilus surinamensis* L.).

The saw-toothed grain beetle is smaller than the flour beetles and of rather a darker brown colour. It may also be recognised by the six saw-toothed projections on each side of the thorax from which the popular name is derived.

Fig. 5.—The Angoumois grain moth. 1.—Adult moth (a), egg (b), wheat grain (c); 2.—Section of wheat grain showing egg and entrance channel of young larva; 3.—Full-grown larva; 4.—Pupa; 5.—Adult moth after leaving by emergence hole as shown
(From U.S. Dept. Agric.).

It is one of the commonest insects found in stored grain in this State, and also attacks many other foodstuffs such as dried fruits, nuts, etc.

The female beetles live from six to 10 months and may lay from 50 to 250 eggs which may be deposited loosely or in the crease of a wheat grain. After three or four days the larvæ appear and two weeks elapse before they spin a thin covering in which to pupate. From egg to adult occupies about four weeks under suitable conditions.

Like the flour beetles, this insect in its adult and larval stage feeds upon flour and damaged grain and assists materially in furthering the damage commenced by the weevils and grain borers.

**Flat Grain Beetles**
(*Læmophlœus* spp.).

The flat grain beetles are amongst the smallest of beetles found in stored grain, being only about one-sixteenth of an inch in length. The colour is reddish brown and the antennæ are relatively much longer than in any other beetles mentioned.

The eggs are laid loosely or in grain crevices and the tiny larvæ form gelatinous cocoons, covered with food particles in which to pupate. From egg to adult occupies about eight or nine weeks.

**Mill Floss, Flour Bugs, and Bran Bugs.**

The beetles described under the heading of "Secondary Insects" are variously known as flour bugs, bran bugs, and mill floss. They are often to be found swarming on bags and in wheat bins and their presence is undesirable, especially in flour mills, but to the farmer or wheat merchant they are not of much consequence and so it is important to be able to distinguish between the primary pests which are able to destroy sound grain and the secondaries which follow in their wake.

This knowledge may save unnecessary anxiety and expenditure in control measures.

## PREVENTIVE MEASURES

**Moisture Content.**

It is generally known that wheat with a high moisture content is more prone to insect attack than that which is very dry, consequently the climatic conditions in Western Australia themselves afford one of the greatest protections to stored grain. Wheat when harvested may contain up to 12 per cent. moisture, but if stored in inland districts the figure may drop in the summer months to as low as eight per cent. or nine per cent. and the scarcity of summer rains favours the safe keeping of the crop. When, as in times of war, grain may have to be stored over one or two winters it is essential to see that no water

Fig. 6.—The confused flour beetle
(From U.S. Dept. Agric.)

is allowed to leak in, as damp wheat is one of the most favourable media for the rapid multiplication of weevils.

Much has been written about the figure at which weevil activity ceases on account of the lack of moisture in wheat, and about 10 per cent. is the figure usually quoted. There is much more work to be done on this matter before this can be taken as final, but it is certainly a guide to the degree of liability to attack, and wheat which can be kept in this dry condition is certaintly less liable to damage than that with a higher moisture content.

**Sanitation.**

This is undoubtedly the most important factor in insect control and scrupulous sanitation should be observed right from the harvester box to the bakehouse door. All wheat should be cleared out of the harvester before it is put away and this ensures that when it is taken out next season clean wheat will not be contaminated before it enters the bags.

**Second Hand Bags.**

The mention of bags brings us to another extremely important point. In districts where bulk installations are present the same bags may be used year after year to cart to the siding. A little grain may be left in the bags when they are put away and this may be sufficient to harbour enough weevils to cause trouble the following year.

When finished with, bags should be turned inside out, thoroughly shaken and brushed, and hung away from any grain. They will then be quite clean and safe when needed later. If there is any reason to suspect that bags have contained weevily wheat, they should be given special treatment and, if possible, placed in boiling water for five or ten minutes as this will kill all stages of insects that may be present and cause only the slightest shrinkage of the bag.

Store houses and sheds should be thoroughly swept of all old grain and refuse and treated with some suitable insecticide, and new wheat should never be stacked near that of another season. Where possible wheat should be stored on a sound grain-proof floor, so that seed cannot trickle through on to the ground beneath and so be out of reach of the broom.

Conveyances, such as railway trucks and lorries should not be overlooked as sources of trouble, as wheat and insects harboured in cracks and runners can easily be responsible for infesting fresh consignments, or even during their passage about the countryside, bringing contamination to clean storage sites.

To carry out the above instructions may seem irksome and fiddling, but if clean wheat is put into a clean container and no infested material is allowed to contaminate it, there will be no trouble from weevils. Never was the saying "Prevention is better than cure" more worthy of observation than in the case of combating storage pests, for once a serious outbreak occurs, its control cannot be obtained without great expense, labour and loss.

A few weevils in the bottom of a bag may be enough to infest a whole bin or even a shipment, and so every farmer should strive to see that his carelessness is not the cause of a widespread loss.

**Storage Methods.**

The bulk storage of grain has much to recommend it for the prevention of insect attack, especially if the bins or silos are of a type that can be readily fumigated or cleaned. On this account steel or concrete bins are desirable, for the walls and floor can be made practically insect-proof and

if thoroughly cleaned before being filled, clean wheat can only be contaminated from the top. The infestation will not penetrate to any great distance, as the weevil is said to be unable to penetrate further than about five feet, and the Grain Moth could only work in a very superficial layer.

Wooden silos are sometimes bored into by various insects; *e.g.* the Grain Borer, and cracks also offer a suitable harbour from which it is difficult to dislodge pests by any other means than fumigation, hence as little woodwork as possible should be employed in constructing grain receptacles.

**Pickling.**

The pickling of wheat for the control of fungus diseases has been found to also constitute a very effective safeguard against "weevils." Copper carbonate dust used at 2 ounces to the bushel and the various mercurial pickling agents have proved effective insecticides. This method of control is, of course, only practical for seed wheat, as pickled wheat is not suitable for milling or for stock.

## PROTECTION OF BAGGED AND BULK WHEAT ON THE FARM

Bins and sheds used for grain storage should be thoroughly cleaned before new seasons wheat or oats are introduced. On no account should new grain be added to old stock. After carefully sweeping out the bin and disposing of old infested grain the walls and floor should be thoroughly sprayed or dusted with an insecticide. If the structure can be reasonably sealed then "Gammexane" smoke bombs or fogging treatments would give a satisfactory kill of the insects still remaining in the cracks and crevices.

Fig. 7.—The rust-red flour beetle (From U.S. Dept. Agric.)

If bagged wheat is being stored the exterior of the bags may be sprayed or dusted as each layer is added. Additional protection may also be obtained by dipping wheat bags in 5% DDT and allowing them to dry before filling.

A liberal sprinkling of DDT or B.H.C. dust (Gammexane or Benzenehexachloride dust) around the base of the completed stack will act as a further protection from crawling weevils.

**Surface Treatment of Bulk Wheat.**

Before filling a silo the walls and floor should be thoroughly dusted or sprayed so that cracks and crevices will contain insecticide. The surface layers of wheat may also be protected by a light dusting with DDT or B.H.C. or by raking the insecticide into the top few inches of grain.

**Insecticides Recommended.**

The dusts recommended are 10% DDT or 10% B.H.C. For the surface treatment of bulk wheat a rate of about 1 oz. to every 17 sq. ft. is recommended. Where spray materials are used 2% water mixture of DDT or Chlordane 0.5% Lindane or Dieldrin should be satisfactory.

## CONTROL

Probably the most universal control treatment for grain pests is fumigation, but other treatments such as heat and insecticides have their place. Many other methods, including electricity and sifting, have been attempted, but without encouraging results. The latter may free the wheat from adults, but does not deal with the eggs and other stages in the grain; hence reinfestation soon follows.

**Fumigation.**

For this method to be effective the container to be treated must be more or less gas tight. Carbon bisulphide and hydrocyanic acid gas are the two most

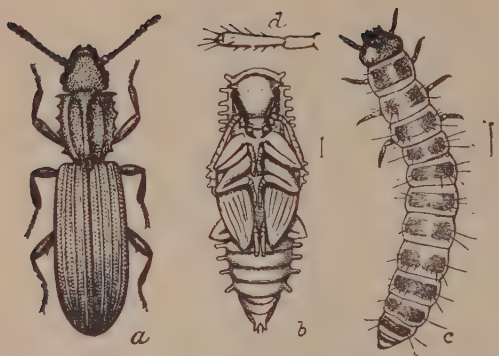



Fig. 8.—The saw-toothed grain beetle. a.—Adult; b.—Pupa; c.—Larva
(From U.S. Dept. Agric.)

common gases used. The latter, being lighter than air, has poor penetrating properties and is more suitable for fumigating containers and mills than quantities of bulk wheat. Temperature is an important factor in fumigation, and a temperature of at least 70° to 75° is desirable for good results, as anything lower tends to reduce the efficiency of many fumigants. The volatilisation of fumigants may be increased either by spraying them into the fumigation chamber or by vaporizing the liquid by the application of heat in an apparatus called a vaporizer.

*Carbon Bisulphide.*

This gas which is heavier than air is very inflammable and explosive and hence requires considerable care in its use. The method of application is to pour the desired amount of liquid into shallow pans or pieces of sacking and place them on the top of the grain. If the depth of grain is greater than five feet, it is desirable to introduce the fluid by means of a pipe with outlets at suitable distances and in this way the gas which is given off will penetrate to all parts. Moist grain may be injured in its germination properties by this gas, and the baking quality of flour is said to be sometimes injured by the vapours, but this may be prevented by airing the flour before baking.

Carbon bisulphide should be applied at the rate of 1 lb. per 25 bushels of grain, or 4 lb. per thousand cubic feet of space to be fumigated. The wheat should remain sealed for 48 hours. If any leakage of gas is likely to occur the amount of fumigant should be increased.

*Hydrocyanic Acid Gas.*

This is chiefly used in this country for fumigating flour mills as the fire hazard is too great when carbon bisulphide is used. Cyanide, however, is very toxic to humans and must be used with great care. The gas may be generated by what is known as the "pot method" or from a number of proprietary preparations.

The standard formula for preparing the gas is as follows:—

Sodium cyanide, 1 ounce.

Commercial Sulphuric Acid, 1½ fluid ounces (3 tablespoonsful).

Water, 2 fluid ounces.

In the case of a mill each storey is treated as a separate unit and made as airtight as possible, but as the gas tends to rise the dosage on the bottom floor should be somewhat increased and the upper ones somewhat decreased. The dosage may be worked out on the basis of 1 lb. of cyanide to 1,000 cubic feet of space for the ground floor.

In preparing the mixture the sulphuric acid should be poured into the water and not vice versa, and the cyanide should be suspended over the earthenware crock, containing the liquid, in a paper bag and lowered in as the door is being closed.

A granular form of cyanide known as Cyanogas G is recommended for mixing with wheat when entering silos at the rate of 1% by weight, and other preparations

Fig. 9.—The flat beetle
(From U.S. Dept. Agric.)

such as Zyklon B and liquid Hydrocyanic Acid may be used as sources of this fumigant.

Grain or buildings treated with Hydrocyanic Acid should be sealed for at least 12 hours and from 24-36 hours if possible.

**Chloropicrin or "Larvacide."**

This gas is also known as tear gas and has given considerable promise as a fumigant. It is non-inflammable and heavier than air. Unsatisfactory points about "larvacide" are that it is detrimental to the baking qualities of flour and has an adverse effect upon seed germination. Also it does not disperse rapidly and as it is highly irritant to the eyes and lungs material and premises must have a lengthy airing after treatment.

Larvacide should be used at the rate of 1 lb. per 1,000 cubic feet of space in airtight bins, the dosage being increased if leakages are unavoidable.

**Fumigant Tablets.**

Various proprietary tablets, as for instance "Phostoxin" pellets, have been recommended for the fumigation of weevil-infested grain. These preparations should be used in strict accordance with the recommendations of the manufacturers. In the case of "Phostoxin" (Aluminium phosphide) the poison gas phosphine is slowly liberated when the chemical is exposed to the air. The residue left by the tablets is quite harmless.

**GENERAL RULES TO BE OBSERVED WHEN FUMIGATING**

1. **See that the container is as airtight as possible.**
2. **Do not fumigate wet or immature grain if it is desired for seed purposes.**
3. **Air foodstuffs or buildings as much as possible after treatment.**
4. **Take all necessary precautions with inflammable or highly toxic fumigants.**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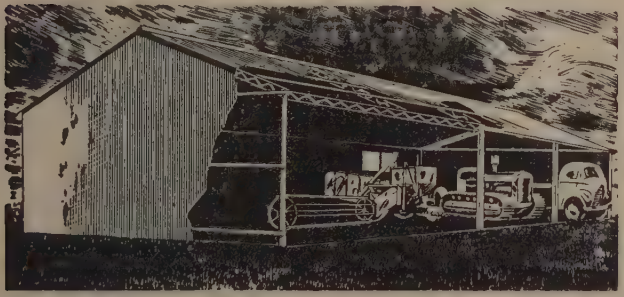

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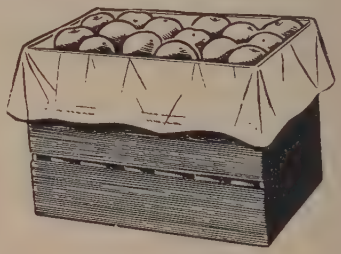

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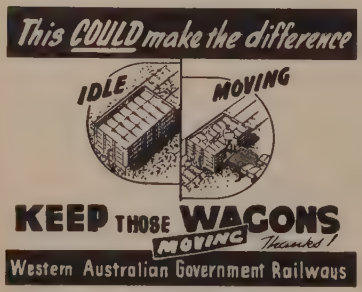


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# WESTERN AUSTRALIAN GOVERNMENT RAILWAYS

Fig. 1.—Mr. E. H. M. Ealey describing kangaroo control measures

# SPINIFEX SCHOOL

ANOTHER PASTORAL INNOVATION

**FOUR years ago, the North-West Branch of the West Australian Department of Agriculture held a field day in the spinifex pastoral area, inland from Port Hedland. The gathering was such an outstanding success that it became an annual event. This year, the field day was preceded by a four-day "school" at which the "students" were 12 local pastoralists and six Departmental officers from as far away as the Kimberleys and Carnarvon.**

The school was held at the Abydos Pastoral Research Station from October 8 to 11 inclusive and the instructors were a team of specialist officers:—the Animal Nutrition Officer (Dr. L. C. Snook), a Government Vererinary Officer (Mr. A. W. Williams), an instructor from the Sheep and Wool Section (Mr. M. Butler), a Research Officer of the C.S.I.R.O. Wild Life Section (Mr. E. H. M. Ealey) and the Regional Adviser of the North-West Branch (Mr. H. Suijdendorp).

## THE ABYDOS STORY

Abydos Station, inland from Port Hedland in the spinifex belt, has an area of nearly 400,000 acres and the adjoining property, Woodstock Station is some 267,000 acres in extent.

About 27 years ago Abydos and Woodstock Stations had a combined sheep population of 33,000, but by 1944 there were only 7,000 sheep on the two properties and by 1946 they were empty and abandoned.

The decline in carrying capacity was not confined to those two stations but was typical—to a greater or lesser degree—of conditions over a large area of spinifex country.

Various factors had contributed to the decline—there had been some drought years, kangaroos had multiplied, dingoes were taking toll of the flocks, and occasional cyclones had caused severe damage.

Fig. 2.—Dr. L. C. Snook lecturing on animal nutrition in a creek bed shaded by dense cadjuput trees

Undoubtedly all these factors had played their part but were there other factors that were even more important? The State Government decided to find out and in 1946 Abydos and Woodstock were purchased as a base for an investigational programme.

The man chosen to carry out the preliminary work was Hank Suijdendorp, a young Dutchman who had commenced his agricultural science studies in Holland, served with the Dutch Navy during World War II and completed his studies at the University of Western Australia.

In the early 1950's he commenced a series of regeneration and stocking management trials at Abydos, as a result of which he evolved the system of "deferred grazing" which has lead to the regeneration of large areas of pastoral country in the district.

He decided that the main factor in the decline of carrying capacity was the selective grazing of the more palatable and more nutritious perennial plants. These were eaten down to such an extent that they had little opportunity to set seed. Often the root reserves were exhausted and the plants died out—leaving the way clear for the multiplication of unpalatable and innutritious herbage which barely provided a maintenance ration and left no margin of nutriment for breeding and lactation.

In "deferred grazing," the stock are excluded from a portion of the run immediately following the first rains. This allows the grasses to seed and build up their root reserves. After seeding is complete, the area is heavily stocked so that seed is trampled into the ground to produce a still better stand when the rains come again.

## POINTS FROM THE PASTORAL SCHOOL

The importance of pastoral production in the Australian economy was stressed by Dr. L. C. Snook, who pointed out that on typical stations in the Port Hedland area the produce sold per man employed could reach a figure of £9,000 per annum, while

Fig. 3.—Mr. Ealey demonstrating his automatic kangaroo marking gate. As the animal pushes the gate open to obtain a drink, it is squirted with blue dye—evidence that it has watered at this particular point

Fig. 4.—Mr. H. Suijdendorp describing the rotational grazing plots

substantial contributions from the gross annual returns of stations were paid out in taxation.

All over the world we could see deserts in low rainfall areas which had once supported pastoral communities and the object of the current school was to show that we could not only maintain a valuable asset but could actually improve carrying capacity by correct management, by introducing suitable pasture plants and by water conservation.

To achieve this desirable end, the pastoralist, the field officer and the scientist must meet and work together.

Dr. Snook said that while it was generally assumed that supplementary feeding of stock was uneconomic under station conditions, this was not necessarily true. Feeding ewes during the period when natural feed was harsh and unpalatable could influence mating so that lambs were dropped when feed was good. The supplementary feeding of ewes near to lambing would pay in many cases by saving animals which otherwise might die.

He discussed methods of feeding to achieve these results, together with estimated costs. Most livestock problems in the pastoral areas stemmed from insufficient feed or a deficiency of some specific substances which were necessary to maintain health.

The effects of feeding on fertility and gestation were discussed.

In a series of lectures and discussions, Mr. H. Suijdendorp described the effects of soil moisture conditions on vegetation under arid conditions; how heavy grazing affected plants; the geological origin of local soils and its effects on plant growth, and the systems of grazing management which would encourage the recovery of the better species of pasture plants.

He discussed spinifex burning as an aid to achieving a better pasture composition by suppressing the harsh undesirable species, and showed by means of experimental plots that the best results were achieved by summer burning.

Burning in December, followed by deferred grazing in the subsequent wet season gave the best results.

Winter (mustering) burning was inadvisable for several reasons. It was apt to destroy seeds of nutritious grasses; it left the soil bare and subject to erosion for periods up to nine months; it often encouraged the growth of undesirable species, and because of the patchy nature

of the burn, the stock tended to congregate on the burnt patches after the rains, so that the areas were stocked far beyond their capacity.

Mr. M. Butler of the Sheep and Wool Section discussed the blowfly menace and gave demonstrations of crutching and mulesing as an aid to minimising flystrike. The "students" were encouraged to try these operations themselves and successfully worked through a flock of 90 sheep under Mr. Butler's supervision. His helpful comments and the pithy anecdotes with which he lent point to his talks were a feature of the school.

The visiting veterinary surgeon, Mr. A. W. Williams, described the sheep diseases which pastoralists are most likely to encounter, particularly those affecting fertility.

He demonstrated the manual examination of rams and the method of vasectomising a ram so that it is rendered infertile but capable of being used as a "teaser."

## KANGAROO CONTROL

Most dyed-in-the-wool pastoralists regard themselves as authorities on kangaroos, but scientific investigations carried out by Mr. "Tim" Ealey of the C.S.I.R.O. Wild Life Section have upset many long-cherished ideas.

At Woodstock Station, Mr. Ealey has been engaged in intensive studies for several years using mechanical and electronic devices to check on the drinking habits of the euros; testing the reactions of the animals to various poisons and endeavouring to amass data which would assist in evolving successful methods of control.

His studies have shown that a large percentage of the kangaroo population in this harsh, dry area of high temperatures habitually go without drinking for weeks at a time—a discovery that has come as a surprise to many people who believed that poisoning water supplies for a few consecutive days would significantly reduce kangaroo numbers.

Some of the school students saw kangaroos being caught in trapping yards and fitted with plastic collars carrying reflector tape symbols so that they could be identified when coming in to drink at night. A spotlight and telescope or binoculars were used in this work. At some mills, all kangaroos coming in to drink were automatically sprayed with coloured dyes to assist in identification.

A popular feature of the school was the showing of coloured slides in the evenings, with informal discussions and "question times."

## A SUCCESSFUL FIELD DAY

Over 60 people attended the fourth annual pastoral field day on Saturday October 12. Bringing their "swags" and "tucker-boxes," some of the pastoralists had come from properties 300 and 400 miles away to take part in the proceedings.

The roll-call of station men included Messrs. B. Knight (Yalgo); J. Stickney (Croydon); J. and M. Featherby (Sherlock); R. Lukis and F. Murray (Munda); D. Haldane (Mallina); P. Corbin (Karratha); J. Lewis and R. Lockyer (Yallalong); R. and K. Eckerman (Mulyie); P. Rushforth (Calliwa); J. Hardie and J. Fisher (Warralong); A. Spring (Roy Hill); C. Newland (Marillana); D. Scott (Eginbah); R. Sharpe (Mardie); W. Rose (Coongan); P. Hardie (Boodarie); J. Richardson (Pippingarra); B. Paterson (Yalleen); D. Shilling and J. Olive (Muccan); J. Leete (Bamboo Springs); G. Mallett (Lime Stone); H. Richardson (Noreena Downs); J. McMacking (Bonny Downs) and J. Kerr (Indee).

The Officer-in-Charge, North-West Branch (Mr. W. M. Nunn), officially opened the field day and welcomed the visitors. The specialist officers, who had lectured at the school, were introduced so that pastoralists could have opportunities of discussing their problems during the day.

The Regional Adviser (Mr. H. Suijendorp) outlined the day's programme and a move was then made to the C.S.I.R.O. kangaroo trapping yards near Woodstock Station homestead where the various trapping, counting and marking devices were inspected and described.

## PASTORAL MANAGEMENT

The next stop was at the original management trial which has been in operation since 1952.

Fig. 5.—Visitors inspecting the kangaroo trapping yards and observation tower at Woodstock station

In this trial, half the plots had received the "deferred grazing" treatment—sheep at the rate of one to four acres being introduced shortly after seed drop in winter each year. The other half of the plots had never been grazed.

The deferred grazing area showed a noteworthy return of perennial grasses while the ungrazed portions carried little vegetation other than harsh spinifex.

The most interesting feature of this trial however was the effect of burning the spinifex at regular intervals. Even where deferred grazing is practised a burn is necessary every four years to prevent the spinifex from crowding out the other species.

Plots illustrated the advantage of burning in November-December prior to the summer rains. Winter burning destroyed valuable seeds and the winter-burnt plots illustrated this most effectively.

## MATING THE EWES

Another stop was made at the oestrus cycle trial where work is in progress to determine the incidence of heat periods in ewes under the conditions prevailing in this area. It is possible that by using vasectomised rams as "teasers" prior to mating, a better conception rate could be achieved. In this regard too, there could possibly be advantages in supplementary feeding or "flushing" of the ewes prior to mating.

## ROTATIONAL V. CONTINUOUS GRAZING

The most important trial inspected was that in which 12 one-acre paddocks in which deferred rotational grazing is practised are compared with a single 12-acre paddock which is grazed continuously. Stocking rates are the same in each case (a sheep to four acres) and the sheep are weighed and wool yields compared.

This season, possibly owing to some good rains, the wool yields were approximately even in both the rotational and continuous grazing sections. Last season the rotational yield was almost double that of the continuous grazing area.

The most striking feature of the trial however is the difference in the pasture species. In the rotationally-grazed section, there is an excellent mixed pasture containing numbers of grasses, mostly perennials, while the continuous grazing section produces nothing but spinifex.

## WATER UTILISATION

After a buffet lunch at Woodstock, capably arranged by Messrs. A. and J. Richardson, visitors were shown a new water-spreading trial which aimed at utilising excess water during the wet season by spreading the run-off over a slope through a series of furrows. This is now prepared and will be tested during the next wet season.

Fig. 6.—Visitors to the field day inspecting the water-harvesting demonstration

Another project was an attempt at "water-harvesting." A low dam has been constructed and a system of furrows dug to utilise the stored water.

This is a small-scale experiment designed to overcome one of the area's main problems—the lack of regularity in the rainfall. It is possible that, by storing excess water, even over short periods, it may be possible to develop small but highly productive areas incorporating better pasture species. On these areas, regular supplementary irrigation could be applied between the irregular heavy falls of rain.

During the evening, each of the specialist officers gave short addresses and answered numerous questions.

The Officer-in-Charge, of the C.S.I.R.O. Wild Life Survey Section (Mr. F. Radcliffe), made an appearance by plane late in the afternoon and addressed the visitors on some of the aspects—and the difficulties—of the C.S.I.R.O. approach to the kangaroo problem.

At the conclusion of the field day, a vote of thanks was moved by Mr. Rob Lukis, Chairman of the Port Hedland branch of the Pastoralists' Association. He was supported by Mr. D. Shilling who had taken a leading part in the many lively discussions at the school lecture sessions.

Both these gentlemen were highly complimentary in their tributes to the quality of the work carried out by the Department of Agriculture but put in a strong plea for more officers to extend the work beyond its present limited confines and to provide an extension service based on the convincing results obtained at Abydos.

In his closing remarks, Mr. W. M. Nunn complimented the Port Hedland branch of the Pastoralists' Association on their ability and willingness to co-operate in matters of common interest. It was this co-operation which had made possible firstly the field days and then the pastoral school.

Port Hedland had set a high standard in this respect and the success of these gatherings was its own reward and a source of pride and gratification to the officers of the North-West branch and the C.S.I.R.O. who were working hard in an endeavour to provide answers to the many problems besetting the pastoral industry.

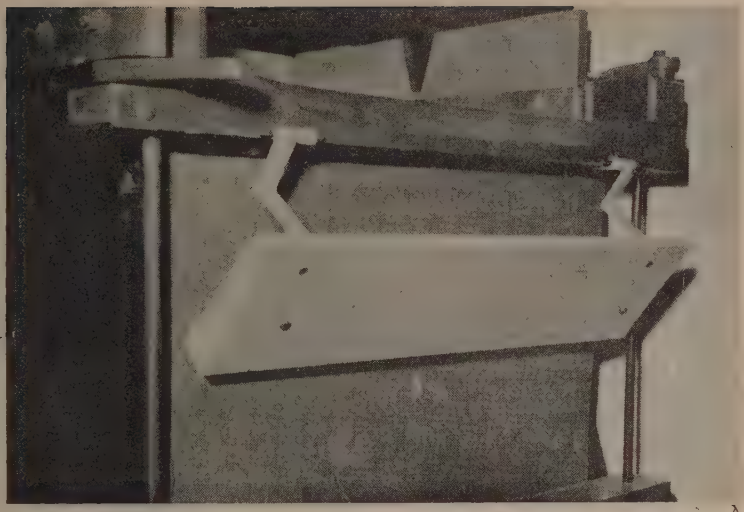

Fig. 1.—The hinged "loose piece"

# Aids To Wool Pressing and Handling

**IN repetitional work, anything which economises in movement or saves a few seconds on each operation can result in worthwhile reductions in time and labour over a period. The Materials Handling Branch of the Commonwealth Department of National Development recently published the following suggestions for improving wool-pressing and handling methods.**

## HINGED LOOSE PIECE FOR WOOL PRESS

Several popular wool presses of the manually operated two box type, have the bottom box constructed with two opposite sides lower than the other two. Two boards, each approximately 28in x 7½in. x 1⅛in. are provided to fit onto the lower sides and when in position, all four sides are of the same height.

These boards, known as "loose pieces," are held in position by locking bars. The bars also secure the flaps of the wool-pack which is arranged as a liner for the bottom box.

The "loose pieces" are left in position until the wool has been compressed to the desired extent. Then, before the tension is released in the ropes holding the monkey-plate, the locking bars and the "loose pieces" are removed and usually dropped onto the floor or carried and placed temporarily out of the way of further operations.

The "loose pieces" are removed to enable the loose cap of the wool pack to be fastened by short pins to the sides of the pack proper, or, if the capless pack method is used, to enable the long skewers to be inserted to hold down the wool while the pack is being fastened.

To eliminate the frequent handlings which are necessary when the orthodox type of "loose piece" is used, the hinged loose piece has been developed. (Figs. 1 and 2.)

The hinged loose piece does not involve any change in pressing techniques. The locking bar is still used to hold the hinged loose piece in position, but the operations of removing the "loose piece" and placing it on the floor and picking it up again are eliminated. Furthermore, the task of placing the "loose piece" into position for the purpose of filling the bottom box is greatly simplified.

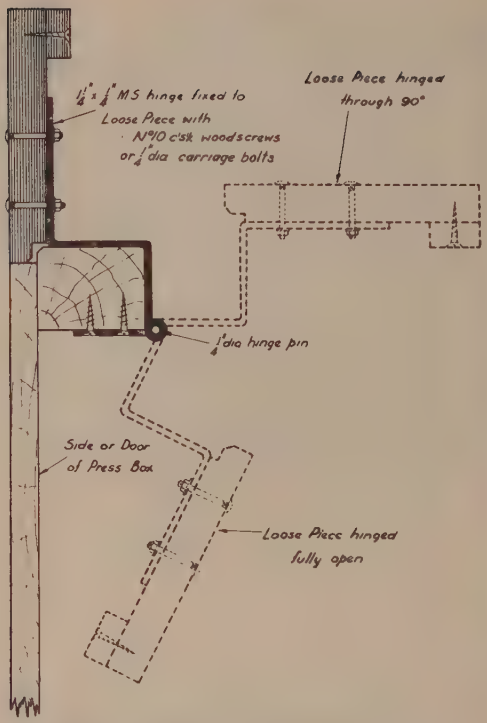
Loose Piece hinged through 90°
MS hinge fixed to Loose Piece with No 10 c'sk woodscrews or dia carriage bolts
dia hinge pin
Side or Door of Press Box
Loose Piece hinged fully open

Fig. 2.—Showing arrangements of hinges

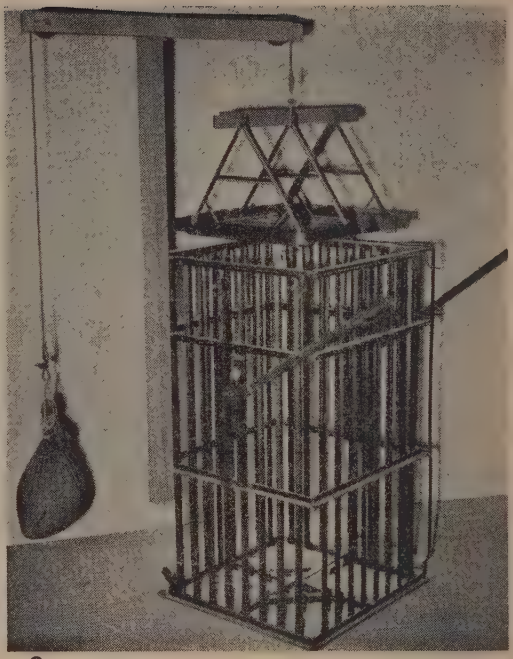

Fig. 3.—Sandbag as counterweight to save lifting the monkey on and off the box

## WOOL PRESS MONKEY SUPPORT

An arduous and time-consuming task in the pressing of wool is the manual handling of the monkey. It is often possible to effect relatively simple modifications to some types of presses to enable the monkey to be supported by a counterweight.

The modification (see Figs. 3 and 4) enables the monkey, which may weigh 50 lb. or more, to be supported for ready use. This eliminates the need to lift the heavy monkey onto the top of the filled box and off again after the wool is pressed. In consequence two lifts are eliminated for each bale made.

The modification consists of a post on top of which is mounted a revolving cross-arm with pulleys fitted at each end. The post is fixed to a suitable corner of the wool press. A rope is attached to the monkey at a point of balance and passed over both pulleys and at its other end attached to a counterbalance weight which could be a bag of sand or earth. Supported in this way the monkey can be

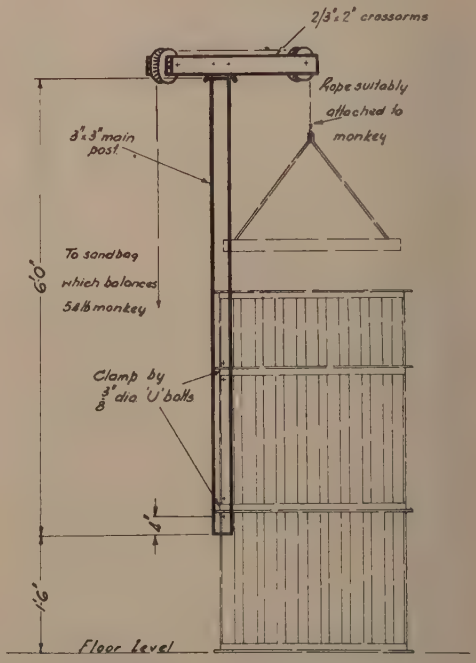


Fig. 4.—Diagram of monkey support

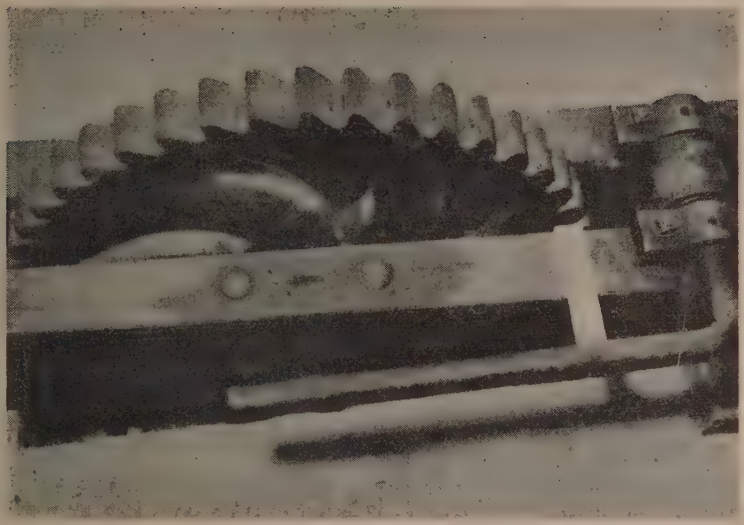

Fig. 5.—A piece of steel (shown in white) keeps the brake lever clear of the floor

raised or lowered easily to any required height or moved laterally away from the top of the wool-press box as necessary.

The post and cross arm can be constructed of either timber or steel as desired. A simple construction is shown.

## STOP FOR HAND BRAKE LEVER FOR MANUAL TWO-BOX TYPE WOOL-PRESS

A number of manually operated two-box types of wool-presses are fitted with a hand brake which in the released position rests on the floor. Frequently the operator uses his foot to raise the lever to a convenient position to grasp it.

A simple steel bar fixed to the bearer (see Fig. 5), or a block wood fastened to the side of the bearer will hold the lever in a convenient position.

## ATTACHMENT FOR EASY RELEASE OF WOOL PRESS PAWL

Some manually operated two-box type wool presses incorporating ratchet wheels and pawls call for the holding pawl to be disengaged by hand before tension can be released on the wire ropes attached to

Fig. 6.—A small hole is drilled in the pawl to take a small bolt (shown in white). This makes it easy to disengage the pawl and prevents it from dropping between the lever arm supports

Fig. 7.—An aid to repacking a bale. The board is turned to leave a space between the wool and the woolpack

the monkey plate. A simple modification to the holding pawl will permit it to be disengaged much more easily and safely.

This modification can be made by drilling and tapping the pawl and inserting a small diameter bolt of about ¼in. diameter and 2in. long. See photograph. (Fig. 6.)

This same bolt also prevents the pawl from falling within the two steel supports which are attached to the lever arm. With this aid the pawl can be lifted clear of the supports as required and without the difficulty often experienced.

This simple and effective aid tends to make pressing easier and faster, and with less possible injury to the hand.

## REBALING AIDS FOR HALF-CAPPED BALES

In displaying wool for sale a proportion of wool bales are half-capped, i.e. some of the fasteners are removed from the bale flaps so that approximately half of the top of the bale is opened (the remainder of the top of the bale is held by the rest of the fastened flaps).

After inspection by buyers and others a quantity of the wool is usually left on the floor in front of the bale. This is frequently replaced by hand and the flaps are brought together manually or aided by strainers.

One way to make space for replacing the wool removed from the bale is by the use of a 4in. x 1in dressed timber board, 36in. long which is pushed down between the wool and the pack with one of its flat sides against the pack. The board is turned through a right angle to form a

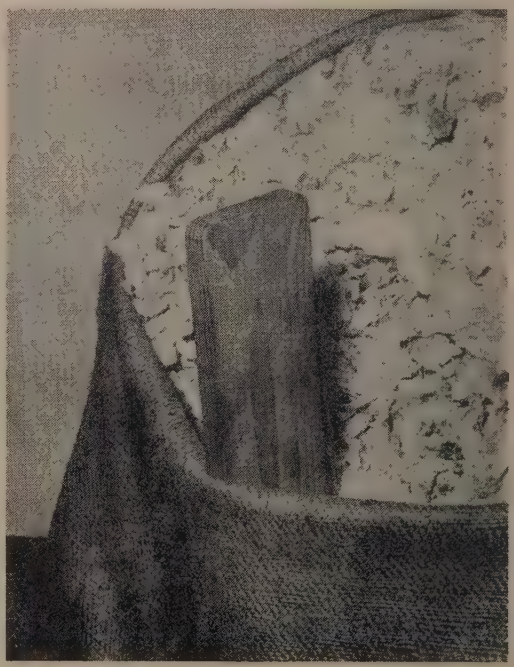

Fig. 8.—A length of timber without the cross-handle may also be used

Fig. 9.—The steel rod type of strainer

pocket in the front of the bale (between the wool and the pack) into which a considerable amount of wool can be inserted by hand. A board with a handle is shown (Fig. 7) but frequently it may be used without a handle (Fig. 8.)

The wool is pushed well down each side of the board into the pocket and when sufficient has been inserted, the board is removed. The bale is left relatively even in shape. If necessary, some of the wool can be replaced into the hole on the top of the bale from which it was removed.

The flaps of the pack are then drawn over and fastened in the usual way. Strainers may be used to bring the flaps of the pack together as is the present custom.

## BALE FLAP STRAINERS FOR REBALING WOOL AFTER DISPLAY FOR SALE

Bale flap strainers are frequently used in wool stores to draw together the flaps of bales which have been repacked by hand. Sometimes they are used to draw together (for resewing) those parts of the

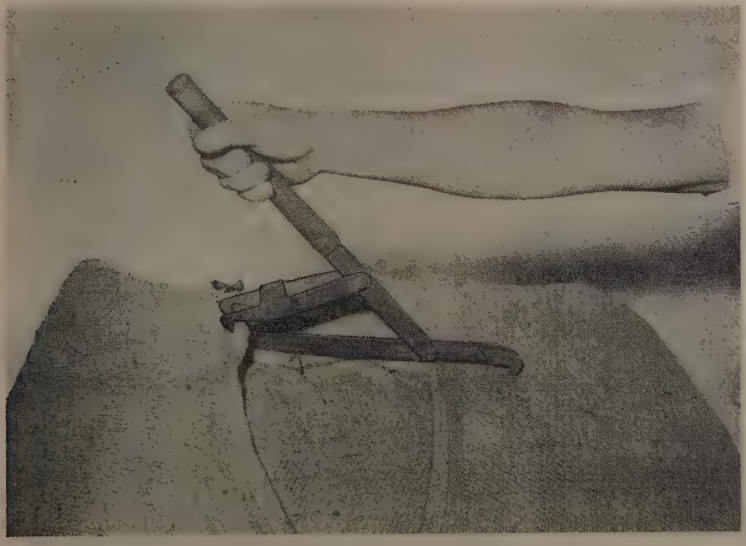

Fig. 10.—The improved lever-type strainer

pack material which have been cut for inspection during display for sale or for sampling following sale.

Two forms of strainers in common use are shown. One consists of a pointed steel rod (Fig. 9) usually tempered spring steel, which is used to draw the flaps over each other and to simplify fastening with the usual metal bale fastener.

The second strainer is made to hook into opposite flaps which with the lever action incorporated in its design enables considerable tension to be applied and the flaps drawn over for fastening. (Fig. 10.)

The design of the second type of bale flap strainer varies. Usually the teeth on the top arm are pointed upwards so that when the flaps are drawn over they are kept apart a distance equal to the depth of the upper arm (about 1½in.) This often makes it difficult to insert the metal bale fasteners.

A study of the lever type strainer showed that the usual form could be modified to improve its effectiveness by setting the teeth in the top arm downwards and by lengthening the bottom arm.

By these modifications the material of the pack is kept close together when drawing one flap towards or over the other, and the pack material directly under the lengthened bottom arm is forced downwards. These changes make it easier to insert the fasteners, draw together the flaps and remove the strainer.


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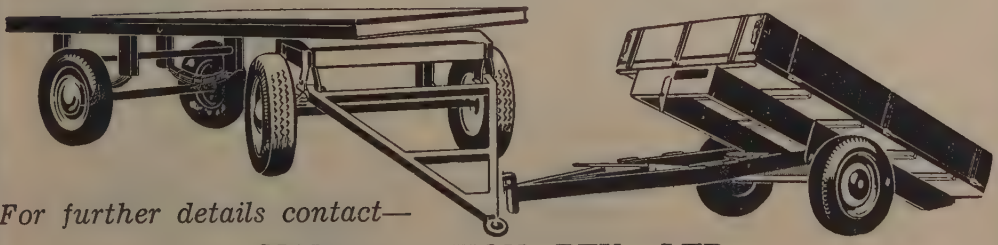

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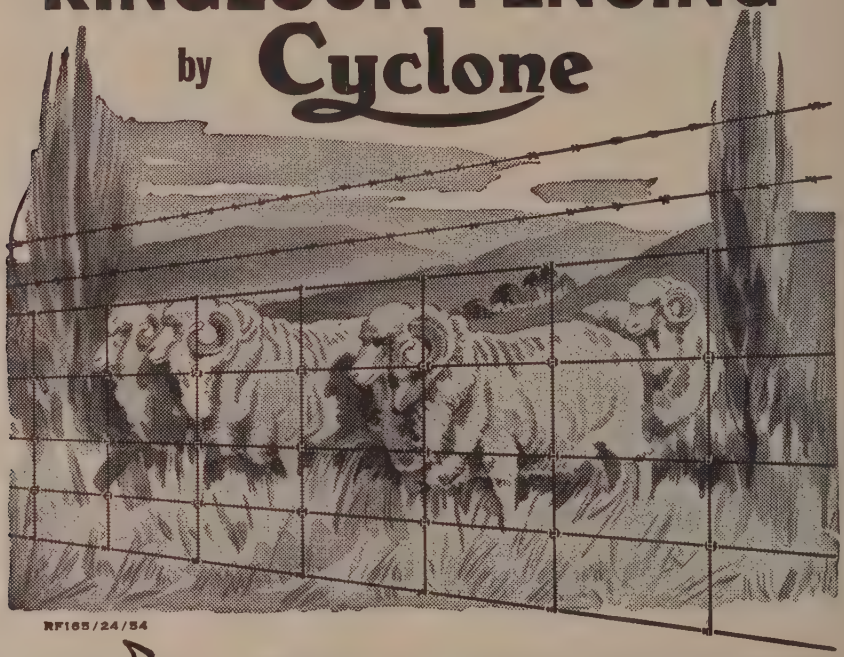

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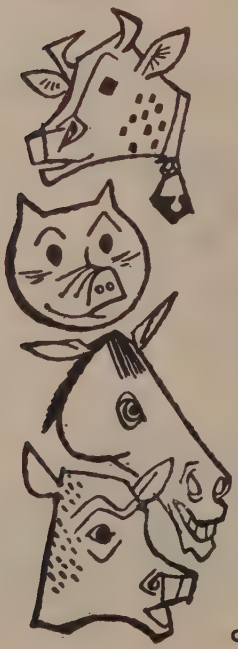

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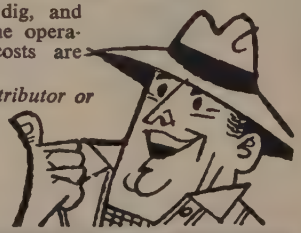

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## CANADA THISTLE

(*Cirsium arvense* (L.) Scop.)

Canada or Creeping Thistle is known to occur in only one locality in Western Australia, but experiences in other countries, particularly Canada and the United States, show its aggressive nature. The plant is a perennial with a vigorous, creeping rooting system which makes eradication very difficult.

# WEEDS of Western Australia

By **G.R.W. MEADLY** M. Sc.
Officer in Charge, Weeds and Seeds Branch

## CANADA THISTLE

### *(Cirsium arvense* (L.) *Scop.)*

**CANADA thistle, also known as creeping and Californian thistle, is a potential rather than an actual weed in Western Australia. It is native to Europe, Asia and Northern Africa, but has found a home in most temperate and warm temperate regions and is a major weed in a number of countries.**

It was reported to have been found about the residences of French missionaries in Canada early in the 17th Century, but there appears to be little foundation to the story that it was purposely introduced for feeding pigs. It may or may not be true that Canada thistle was introduced into eastern New York with the hay and camp equipage of Burgoyne's army in 1777 but there is no doubt that it was distributed widely in Canada and America as an impurity in hay. The weed spread rapidly across the northern tier of the United States, being reported in Northern California as early as 1879, and also occurs throughout the agricultural areas of all provinces in Canada. It maintains a reputation as an aggressive and pernicious weed throughout an extensive territory in North America.

Canada thistle was introduced to New Zealand in about 1870 and spread rapidly to most parts of the country, particularly in the South Island. In 1894 the Government offered a reward of £250 for an effective method of eradication and Canada thistle probably had much to do with the passing of a Noxious Weeds Act in 1901. The plant has survived, however, and remains one of the most troublesome weeds in New Zealand.

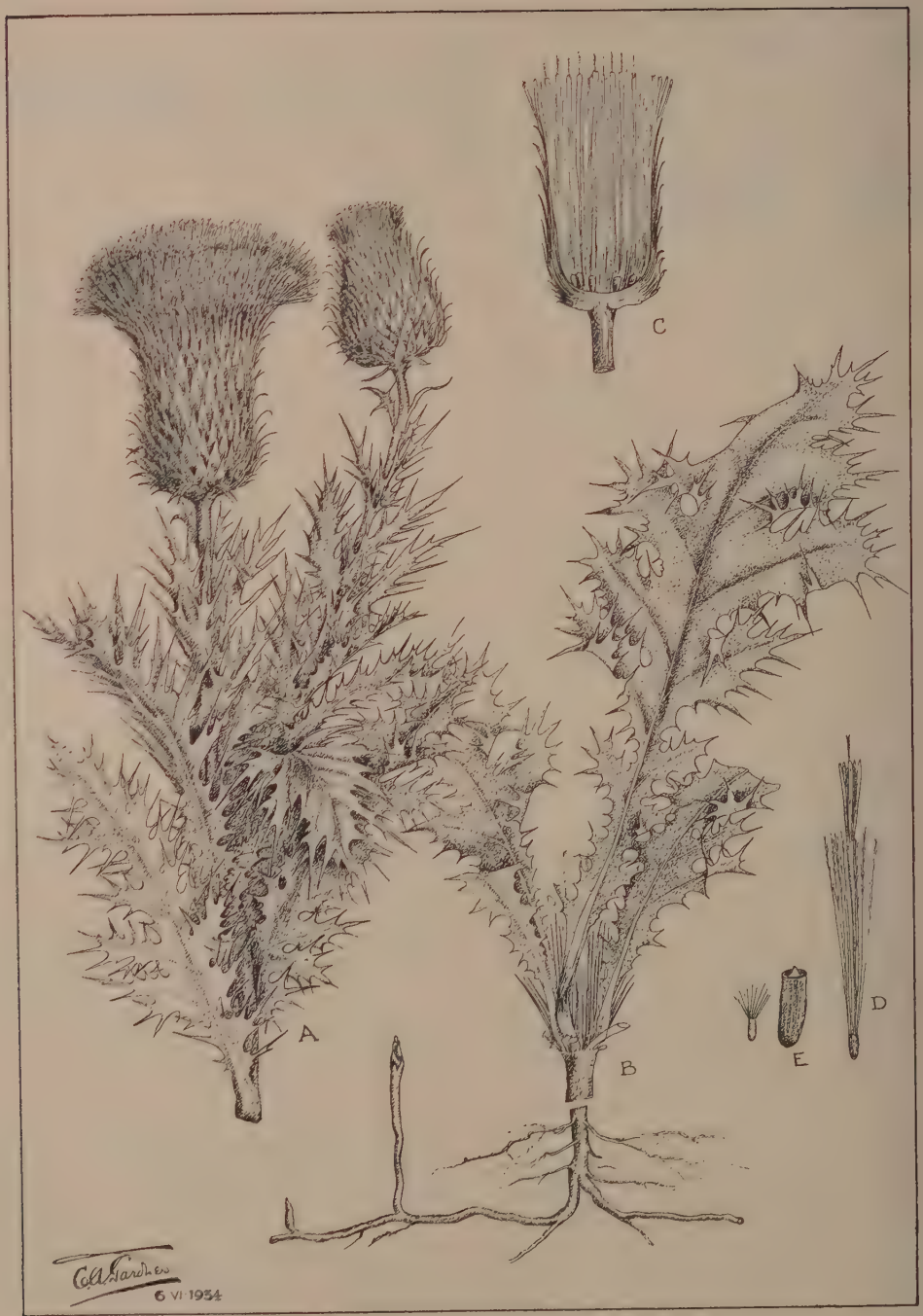
It had reached serious proportions in Tasmania by the beginning of this century and, although checked by the ravages of a "blight," usually attributed to a rust fungus, is still a very significant weed. On the mainland it has its greatest development in Victoria, with more restricted infestations on the Southern Tablelands of New South Wales and in the south-east portion of South Australia.

Canada thistle was first recorded for Western Australia in 1933 when a few plants were located in the Geraldton district. These have since been destroyed but more recently a small infestation growing in association with ragwort was found on a property at Walpole. This is now well under control.

#### DESCRIPTION

Canada thistle is known by a number of other common names including creeping and Californian thistle. Creeping thistle describes the habit of the plant which, although not native to Canada and California, is so thoroughly established in those places that the names must be regarded as being appropriate.

It is a perennial, 1-2ft. in height, with horizontally creeping, thickened, white or yellowish, branched roots from which erect




CANADA THISTLE.
*Cirsium arvense* (L.) Scop.

A.—Flowering shoot; B.—Showing the growth habit of the plant, including basal leaves, creeping stems and different stages of vertical shoots; C.—Section through flower head; D.—Male flower (enlarged); E.—Achenes ("seeds"). The one showing the pappus is reduced in size, and the other is enlarged.

stems are produced at irregular intervals. The branched stems are green, cobwebby and with variable development of hairs. The green leaves are almost hairless above and woolly-white or cobwebby underneath. They are lance-shaped in outline, deeply lobed and undulate with marginal prickles or spines, and also terminating in a spine. The narrowed base is continued down the stem beyond the insertion of the leaf giving the impression of a spiny stem.

The stalked or sessile flower heads are dioecious i.e. the male and females borne on different plants. The florets are surrounded by many closely overlapping bracts, the outer short, sometimes tipped with weak spines, the inner successively longer and narrower with long pointed tips. The florets are reddish-violet or rarely white and are fragrant.

The achenes ("seeds") are about $\frac{1}{8}$in. long, more or less four-angled and with a somewhat glossy surface. The white hairy pappus at the apex of the achenes falls, leaving a circular rim within which is a small projection.

Flowering usually occurs between November and February. Large patches of Canada thistle may consist entirely of male plants. If such plants are examined no seeds will be found, contributing to the opinion that this thistle is a poor seed producer. When the male and female plants are not far removed, however, generous seed formation occurs although often affected by larvae of various insects.

Canada thistle should not be confused with the related and somewhat similar spear and sheep thistles which are biennial and annual respectively. The creeping rooting system of Canada thistle is distinctive.

## SIGNIFICANCE

Canada thistle has the undesirable characteristics of a perennial weed with a strong, creeping root system. It can act as a vigorous competitor for both crops and pastures. Its importance as a weed can be gauged by reaction in other countries. In England it is classed as the commonest and most troublesome of all thistles, being abundant on all types of arable land and pastures. Besides competing with the legitimate crop it takes the edge off the mowing knives, and the prickles can prove most uncomfortable when handling hay.

A survey carried out in New Zealand showed that it was regarded as being the worst weed in 511 of the 669 districts from which replies were received. It is one of the most feared weeds in the United States, having been declared noxious in the Seed Laws of 37 States. In Canada it is described as the commonest and most troublesome thistle in cultivated fields, meadows, pastures, roadsides and waste places, growing under a wide variety of soil and moisture conditions although less common on light dry soils.

## CONTROL

Control measures should be designed to prevent seeding and destroy the perennial rooting system. When only a few plants occur they should be grubbed. With more extensive infestations, where cultivation can be carried out, this should be repeated as often as necessary to cope with shoots before or immediately after they appear in order to systematically weaken the plants. If the surface soil is dried out, the severed portions have less chance of rooting. Tasmanian experience has shown that implements used should have a horizontal cutting action such as a thistle shaver, broad-toothed cultivator or mould-board plough. Implements with a vertical cutting or pulverising action tend to multiply the pieces of root and distribute them to clean soil. In America it has been observed that portions of root or root-stock $\frac{1}{8}$in. to $\frac{1}{4}$in. in diameter and $\frac{1}{2}$in. long will produce new plants under favourable conditions.

The maintenance of a thick stand of lucerne for several years will reduce an infestation of Canada thistle. The lucerne shades the thistle rosettes, and cutting the crop two or three times a year reduces the storage reserves and consequently the vigour of the thistle roots. Where conditions are favourable, the growing of summer crops such as Sudan grass, sorghum and millet has also proved useful. Canada thistle is not eaten readily by stock but is held in check by a vigorous pasture, particularly if regular mowings are carried out.

Although Canada thistle is not highly susceptible, the hormone-like herbicides are very helpful. Best results follow spraying when the flower buds are clearly visible but not open. Complete control is rarely obtained from a single treatment and there is no advantage in applying more than 2 lb. acid equivalent of 2,4-D per acre. Regrowth should be treated as it appears.

Reference has already been made to a "blight" affecting the growth of Canada thistle in Tasmania. The possibility of using one or more fungi for the control of the weed was investigated in New Zealand about 40 years ago. It was concluded that although up to half the treated plants could become affected, spectacular kills were not assured and the method had little practical value.

## FARMERS

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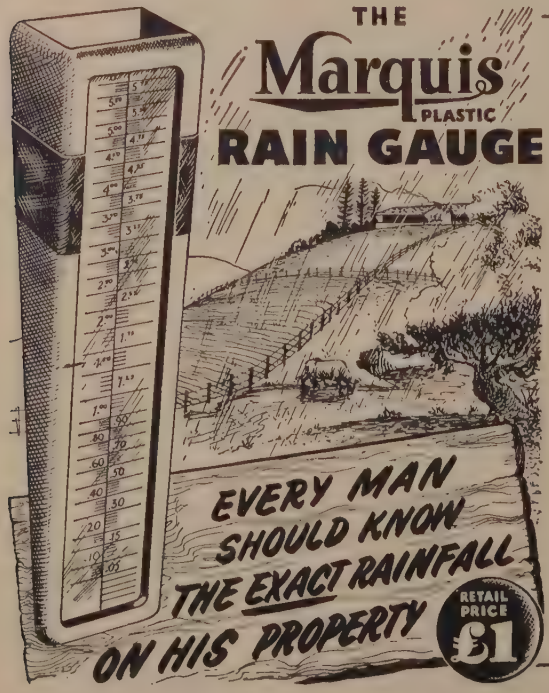


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Fig. 1.—Poultry shed under construction, showing nests and feed chute

# HOUSEHOLD POULTRY-KEEPING

## How To Get the Best Results From the Backyard Flock

By R. H. MORRIS, Officer-in-Charge, Poultry Branch; R. VAGG, Poultry Instructor and M. W. G. CRITCHELL, Poultry Inspector

**THE widespread popularity of backyard poultry-keeping in Western Australia probably stems from our long-established tendency towards spacious living. Many of our suburban building blocks are approximately a quarter of an acre in extent so that the average householder has ample space to accommodate a few hens.**

Whether backyard poultry keeping is desirable or not is a debatable point and one which cannot be answered by citing individual case-histories because of the many factors which are involved.

If established and managed in accordance with the recommendations made in this article, the backyard poultry unit should be neither unsightly nor unhygienic.

On the other hand, the type of building and equipment advocated here would involve a certain cash outlay, and the question of whether such outlay could be effectively offset by the gain in fresh eggs, poultry meat, fertiliser for the home garden and the provision of an interesting hobby is a matter for the individual householder to decide.

Obviously, the quality of the birds kept, the price of poultry foods, the owner's skill as a handyman and his degree of poultry-raising knowledge, as well as the manner in which he utilises the poultry droppings as garden fertiliser are but a few of the "intangibles" which would affect the profit and loss account in the final assessment.

### REGULATIONS

At the present time there is no need for the householder to license poultry but there are restrictions regarding the sale of surplus eggs.

If a person has less than 20 hens and wishes to sell eggs, other than to the Western Australian Egg Marketing Board, or to a person who holds an egg purchasing permit, he must apply to the Director of Agriculture, St. George's Terrace, Perth, for a "certificate of approval" to sell eggs. On application for this certificate the regulations pertaining thereto will be further explained.

Any person with 20 or more laying fowls wishing to sell eggs privately should inquire at the Western Australian Egg Marketing Board, 39 Marquis Street, West Perth, for details of the necessary procedure.

Any person wishing to sell eggs direct to the Egg Marketing Board, merely delivers his surplus eggs to the egg floor.

The various local authorities have their own regulations in connection with the keeping of poultry on suburban lots, so that anyone intending to keep poultry should contact his local health authority and make himself conversant with the by-laws controlling poultry in his particular area.

## THE POULTRY SHED

Correct housing is an important factor in profitable egg-production, and as the poultry-shed is to be a permanent feature of the backyard, it should be well-designed, well-constructed and suitably sited.

The shed shown in the illustrations can be recommended with confidence. It measures 12ft. x 8ft. and is divided into two 6ft. x 8ft. compartments. One compartment will house up to 12 laying hens which should supply the needs of the average family. The second compartment is reserved for the new season's pullets which will replace the older birds as they reach the end of their profitable laying period.

One 6ft. x 8ft. compartment will house up to 12 hens on an intensive basis, that is they are confined to the shed without an outside run. The pullets may be also reared intensively but more uniform development is likely to be attained if they are provided with a clean grassed run. It will be noticed that the plan allows for a 12ft. x 20ft. yard at the rear of the shed As soon as the new season's pullets come into lay, they should be confined to the shed and the yard allowed to rest or planted to vegetables until the next season's chickens arrive.

**Watering.**

Both compartments are identically equipped with automatic watering devices (Francis drinker type) which assure a plentiful supply of water at all times and only need to be washed out two or three times weekly.

Several types of automatic watering systems may be purchased from suppliers of poultry requisites. The one recommended is operated by the weight of water in the trough. As the quantity of water decreases, fresh supplies are added automatically.

Two separate troughs are used, one to each compartment to assist in disease control. (Young chickens are highly susceptible to disease germs which may not affect older birds.)

Each trough is 3ft. in length and is located outside the shed. A grid of $\frac{3}{8}$in. steel rods spaced 2$\frac{1}{2}$in. apart allows the adult birds to poke their heads through to reach the water. Much closer spacing is required for the chickens and this is achieved by boring holes at appropriate distances apart in the upper and lower trimmers so that lengths of rod can be dropped in and taken out as required. The chicks will also require a ramp up which to walk to reach the water.

**Feed Troughs.**

Feed troughs, as illustrated, are supplied, one to each compartment. These are placed near the front of the shed where built-in chutes permit the troughs to be replenished without entering the shed.

**Nest Boxes.**

Built-in community nests, one to each compartment, are situated above the feed troughs, where they fit between the front studs. Constructional details of the nests are shown in the illustrations. Sliding doors allow the eggs to be collected from outside the shed.

Clean white sawdust is the best nesting material, but chaff, straw or wood-wool may be used. The birds enter and leave

Fig. 2.—Poultry shed completed. Note the slides for collecting eggs from the nests, the feed chutes and removable panels on the lower portions of the doors

the nest through the 7½in. diameter circular hole, and a hinged alighting board on the front of the nest can be raised to close the entrance at night.

**Summer Ventilation.**

The wire-netted door of the shed is fitted with a removable panel in the lower portion. This may be removed in summer to admit fresh air and sunshine. A 12in. deep section of the back wall above the water-troughs is hinged and may be suspended on a pair of large cabin hooks and eyes to give extra summer ventilation.

**Deep Litter.**

The shed shown here is designed to permit use of deep litter—a system which has achieved widespread popularity in recent years as it saves labour, reduces fly-breeding to a minimum and confines the droppings to a small area.

A deep litter shed is only cleaned out once a year, yet it is clean and odourless and birds reared on deep litter enjoy excellent health.

The floor should be concreted and is covered to a depth of two or three inches with sawdust, chopped straw or chaff. This material must be dry when put down and must be maintained in a reasonably dry condition. **Deep litter should never be allowed to become wet.**

Deep litter operates on a principle similar to that of a compost heap. The droppings fall on the litter where they are rapidly decomposed by the action of bacteria. Well-managed deep litter gradually builds up to a depth of six or eight inches of almost dry, friable, clean-handling and practically odourless material that is similar in composition to well-made compost and is equally valuable as a garden fertiliser.

The moisture contained in the fowl droppings is adequate for the requirements of the bacteria—additional moisture checks their activities and the system breaks down.

If the litter shows signs of becoming too damp and tends to pack down, it should be forked over and hydrated lime should be mixed with it at the rate of 1 lb. to every six square feet (8 lb. to each compartment). The birds should be encouraged to scratch in the litter to maintain it in a loose friable condition.

Deep litter does away with the necessity for frequent shed-cleaning. This, in conjunction with the automatic watering system and the capacious feed-troughs, makes it possible to leave the birds unattended

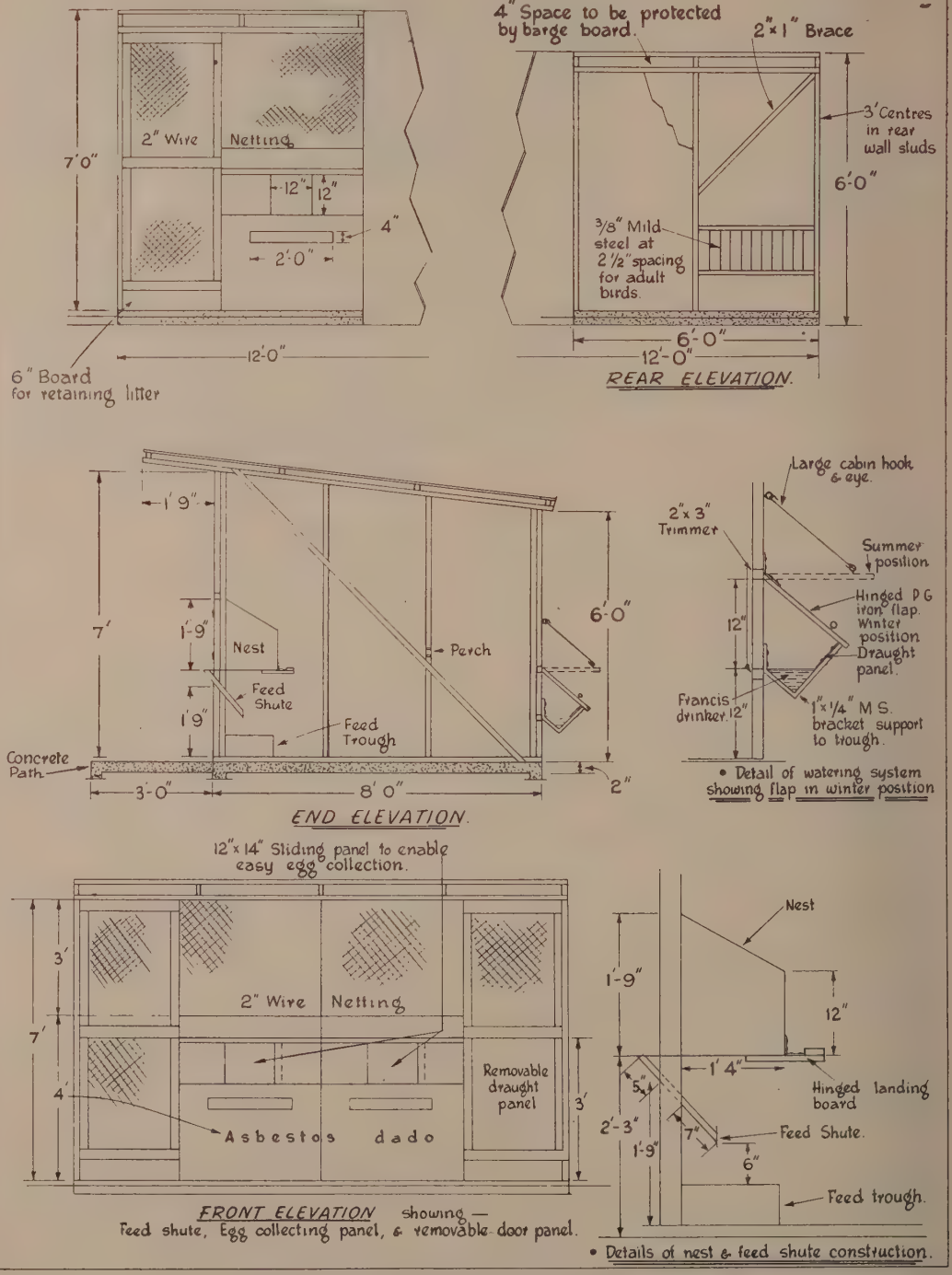



Fig. 3.—Constructional details of poultry shed

for a few days with perfect safety, making it unnecessary to depend upon one's neighbours to attend the birds during short absences from home.

**The Purpose of the Two Compartments.**

For profitable backyard poultry-keeping, we do not recommend holding birds for longer than 16 months after they come into lay.

Pullets purchased at six to eight weeks old in late September or early October should commence laying in January. By the following January when these birds have been laying for 12 months there should be a new batch of pullets ready to replace them.

Possibly two or three of the older birds will have died or been culled during the year and among the remainder there may be birds that are worth retaining for a further four months.

The two compartments enable the older birds to be kept separately. When the old season's hens are finally disposed of in April, one compartment could be utilised for rearing a few cockerels for the table.

These should take 12 to 16 weeks to grow to table size so that there will be time to rear the cockerels and dispose of them before cleaning and disinfecting the shed in readiness to receive the batch of new 6-8 week old pullets in September or early October.

**Siting the Shed.**

Before erecting the shed, study the site carefully. Where possible, have the shed facing north-east or east so that it is not exposed to strong winds and is protected from driving rains and fierce summer sunshine.

Any existing shade or shelter in the form of trees, hedges or fences should be utilised to the best advantage when siting the shed.

Failing adequate shade being available we suggest that shade trees should be planted as indicated on the plan.

The white cedar or Cape lilac makes a satisfactory shade tree for the metropolitan area, as it grows quickly and withstands lopping or pruning to maintain it at a suitable size and shape.

**MATERIALS REQUIRED FOR POULTRY SHED**

**Front Wall.**

Corner Studs—3in. x 3in. 2/7ft.
Intermediate Studs—3in. x 2in. 3/7ft., 4/4ft.
Trimmers—3in. x 2in. 2/4ft., 2/2ft.
Door Timber—3in. x 1in. 2/8ft., 4/7ft., 6/2ft.
Plates—3in. x 2in. 2/12ft.
Asbestos-Cement—1 sheet 8ft. x 4ft.
Netting—4yds. of 3ft. x 2in. 19 gauge.
Hinges—2 pairs 10in. Tee.
D Gate Latches—2.
Slide Runners—4/4ft.
Slides—2 pieces 12in. x 14in. plain galv. iron.
Removable Door Panels—2 pieces 2ft. x 3ft. plain galv. iron.

**Back Wall.**

Corner Studs—3in. x 3in. 2/6ft.
Intermediate Studs—3in. x 2in. 3/6ft.
Brace—2in. x ¾in. 1/9ft.
Trimmers—3in. x 2in. 8/3ft.
Plates—3in. x 2in. 2/12ft.
Barge Board—7in. x 1in. 1/12ft.
Corrugated Galv. Iron—5/6ft. sheets.
Plain Galv. Iron (flaps).
Mild Steel Brackets for Drinking Trough.
Cabin Hooks and Eyes.
Francis Drinkers.

**Ends.**

Studs—3in. x 2in. 4/7ft.
Plates—3in. x 2in. 4/8ft.
Braces—2in. x ¾in. 2/10ft.
Corrugated Galv. Iron—7/8ft. sheets.

**Partition.**

Studs—3in. x 2in. 2/7ft.
Plate—3in. x 2in. 1/8ft.
Trimmers—3in. x 2in. 1/8ft.
Corrugated Galv. Iron—2/8ft. sheets.
Netting—8ft. of 3ft. x 2in. 19 gauge.

**Roof.**

Rafters—4in. x 2in. 5/10ft.
Purlins—3in. x 1½in. 4/12ft.
Corrugated Galv. Iron—6/10ft. sheets.
Edge Roll—4/6ft.

**Miscellaneous.**

Perches—3in. x 2in. 2/6ft.

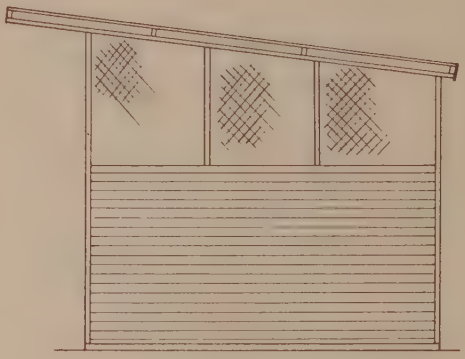
**FLY CONTROL.**

Even under the best of housing conditions poultry will attract flies and it is important to control these pests.

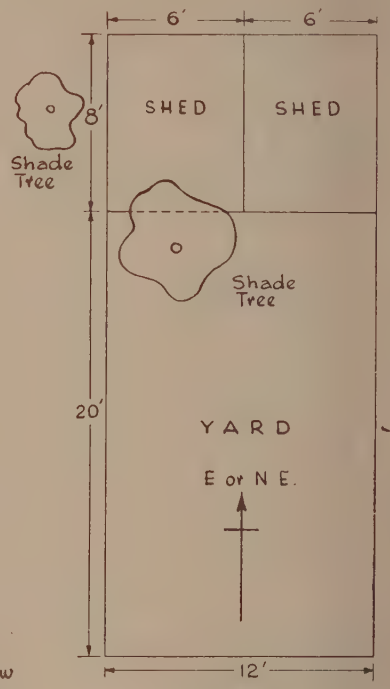
Let us consider some methods of fly control around the poultry house.

(a) Never allow poultry droppings to become wet, as wet droppings provide an excellent breeding place for flies.

(b) Keep poultry yards free from decomposing food scraps and heavy concentrations of poultry excreta.



PARTITION — Division wall — to be sheeted 4' high with galv' corrugated iron with 2" wire netting above.




PLAN

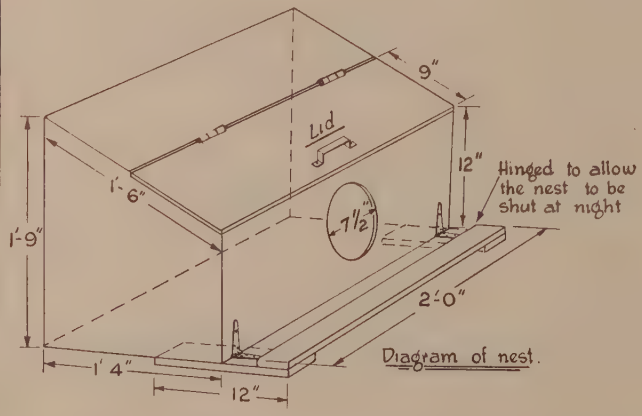
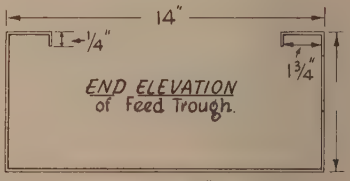
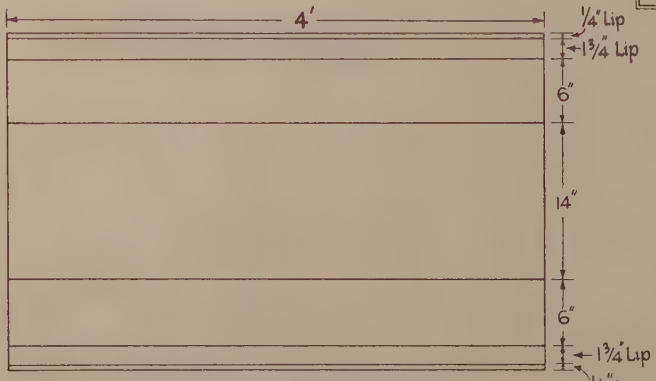


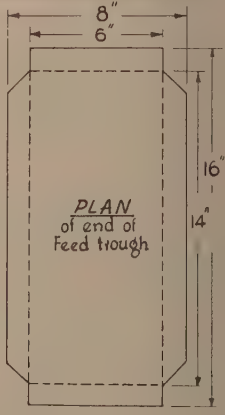

Diagram of nest.




END ELEVATION of Feed Trough.




PLAN of main section of trough.




PLAN of end of Feed trough

Fig. 4.—Details of construction of partition, nest-box, and feed trough, also ground plan of sheds and yards

Muddy yards are to be avoided as they attract flies and provide a suitable breeding ground for them.

(c) Use an outdoor spray which does not harm the birds and which has a residual killing effect for some weeks after application.

Three modern fly killing agents with a residual effect are:—

**Malathion Mixture.**

1 oz. 50 per cent. malathion.
1 lb. sugar.
1 gallon water.

This preparation can be used as a bait or spray. The mixture should be sprayed on the walls and floor of the shed.

**Diazinon.**

To be used in accordance with the manufacturer's directions.

**Dipterex.**

Use 1 oz. dipterex in 3 gallons water and spray the walls and floor with a light application of the mixture.

Care must be exercised when using these sprays, never to allow the mixture to contaminate the feed or water.

# STOCKING THE SHED

**A FLOCK of 12 good laying pullets replaced every year will ensure a constant supply of eggs for the average family throughout the year. It is quite unnecessary to keep a cockerel to promote egg production and in any case the presence of a crowing cockerel is apt to annoy the neighbours. Furthermore, fertile eggs do not have the keeping qualities of infertile eggs and will deteriorate rapidly in warm weather.**

Although a good pullet can be quite profitable in her second season of lay there are a number of reasons why the birds should not be retained in the household flock for longer than a 12 to 16 months laying period. Apart from the difficulty which some people may experience in knowing which birds are worthy of retention, there is a rapid fall-off in productivity after the first laying period and most hens moult and look for a rest in the autumn and early winter when the eggs are most required. The keeping of old birds also creates a housing problem in that it is good policy to house only birds of the one age together and unless the old birds are disposed of at a set time each year the stocking programme is severely interfered with.

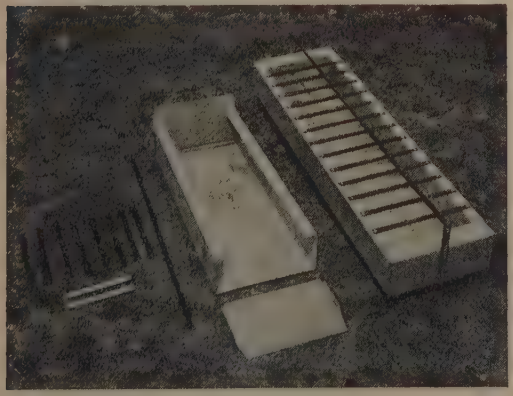


Fig. 5.—Feed trough showing component parts. The anti-perching roller over the trough may be omitted

## THE POPULAR BREEDS

The two main pure breeds used in Western Australia are the Australorp and the White Leghorn. The first-named is a heavy bird which is noted for good winter egg production; the White Leghorn is a light, active breed that tends to be flighty and highly-strung although strains vary in this respect. It is especially renowned for its spring and summer laying.

The "First Cross," which is usually obtained by mating a White Leghorn male with Australorp females, is a popular laying bird which meets the requirements of the household poultry-keeper particularly well.

It has an egg-laying capacity equal to, if not better than, many strains of pure breeds, and is a strong, vigorous, medium-weight bird, lacking the flightiness of the Leghorn and tending to continue laying over most months of the year. Strains of the reverse cross in which the incidence of broodiness is kept within reasonable limits by selective breeding can also be expected to give good results, as can the progeny from the White Leghorn x Rhode Island Red mating.

Fig. 6.—Australorp hen

### WHEN TO BUY

To be sure of placing 12 laying birds in the shed each year, it is advisable to purchase 14 six to eight-week-old pullets from a reliable hatchery or "started chick" specialist.

Purchasing good "started chicks" as they are termed is recommended in preference to buying day-old chicks which require brooding equipment and special attention if they are to be reared successfully. However, in making this recommendation, it is assumed that the average householder appreciates how very important it is for the young chickens to be given a good start in life if they are to perform satisfactorily later on, and with this in view the prospective purchaser of "started chickens" is strongly advised to personally inspect the stock before he buys them to see that they are healthy and well grown for their age.

It is essential that your chickens should be well-fed and well-managed early in life and unless you can be sure of securing top quality started chickens you are advised to go the extra trouble of rearing day-olds.

Many household poultry-keepers have difficulty in obtaining sufficient eggs in the autumn and this is mainly due to the fact that their pullets have been hatched at the wrong time, or that the flock is carrying too many old hens.

The commercial egg producer has various methods of achieving good autumn and winter production—for instance by artificially lighting the laying sheds—but for the backyard poultryman the best plan is to obtain chickens hatched late in August. These should come into lay in January and if managed in accordance with the recommendations made in this article, the majority should continue in production through the year.

## FEEDING THE BIRDS

**CORRECT feeding plays an all-important part in the management of poultry, and most householders will find it a distinct advantage to purchase a reliable brand of proprietary mash or pellets in preference to mixing their own. Should you decide to use a prepared mash, care must be taken to ensure that the correct mixture is purchased in accordance with the age of the birds and the method of feeding.**

The following recommendations apply under the "all-mash" system of feeding in which no grain is fed—

From day-old to 7 weeks, a chick starter with 16 per cent. of protein should be fed.

From 8 weeks to 12 weeks, a 15 per cent. protein mash is required.

From 13 weeks to 18 weeks, a 14 per cent. protein grower's mash should be fed.

From 18 weeks onwards in the case of the all-mash system of feeding, a 16 per cent. protein layer's ration should be fed, or if whole grain is being fed at the rate of 2 oz. per bird per day, a 20 per cent. protein mash is required. Pellets with the same feeding value as the mashes listed are available and can be substituted if desired. Very small pellets called granules are available for small chickens.

All the above mashes should be fortified with Vitamins A and D3 and wherever possible, fresh chaffed-up greenfeed should be fed daily in addition to the mashes.

Should you wish to prepare your own poultry mash and rear your own chicks from day-old, the following poultry feed mixtures will give good results. Rations 1, 2, 3 and 4 are designed to be fed under the all-mash system of feeding.

**1. From day-old to 7 week (16% Protein Ration).**

| Ingredient. | lb. |
|---|---|
| Bran | 3 |
| Pollard | 3 |
| Wheatmeal (coarsely gristed) | 10 |
| Whalemeal (60 per cent. protein) | 1½ |
| Buttermilk powder | ⅔ |
| Dried brewer's yeast | ½ |
| Boneflour | 1 |
| | 19⅔ |

To every 20 lb. of this mixture add 1 tablespoon of a reliable Vitamin A and D3 supplement containing 5,000 International Units of Vitamin A per gramme or its equivalent. These supplements are available from suppliers of poultry foods.

**2. From 8 weeks to 12 weeks (15% Protein Ration).**

| Ingredient. | lb. |
|---|---|
| Bran | 5½ |
| Pollard | 4 |
| Wheatmeal (coarsely gristed) | 14½ |
| Whalemeal (60 per cent. protein) | 2½ |
| Boneflour | 1½ |
| | 28 |

Also include 1 tablespoon of a reputable Vitamin A supplement containing 5,000 International Units of Vitamin A per gramme.

**3. From 13 weeks to 18 weeks (14% Protein Ration).**

| Ingredient. | lb. |
|---|---|
| Bran | 5 |
| Pollard | 2 |
| Wheatmeal (coarsely gristed) | 14 |
| Whalemeal (60 per cent. protein) | 1½ |
| Boneflour | 1 |
| | 23½ |

Also include 1 tablespoon of a Vitamin A supplement containing 5,000 International Units of Vitamin A per gramme.

**4. 16 per cent. Protein All-mash Layer's Ration.**

| Ingredient. | lb. |
|---|---|
| Bran | 6 |
| Pollard | 2 |
| Wheatmeal (coarsely gristed) | 12 |
| Whalemeal (60 per cent. protein) | 2½ |
| Boneflour | ¾ |
| Oysterflour | ¼ |
| | 23½ |

Also include 1 tablespoon of a Vitamin A supplement containing 5,000 International Units of Vitamin A per gramme or its equivalent.

**5. 20 per cent. Protein Layer's Ration** (fed ad lib together with 2oz. of wheat per bird per day).

| Ingredient. | lb. |
|---|---|
| Bran | 4 |
| Pollard | 2 |
| Wheatmeal (coarsely gristed) | 3 |
| Whalemeal (60 per cent. protein) | 2 |
| Boneflour | ¾ |
| Oysterflour | ¼ |
| | 12 |

Also include 1 tablespoon of a Vitamin A supplement containing 5,000 International Units of Vitamin A per gramme or its equivalent.

In addition to these rations, fresh succulent greenfeed should be fed daily at the rate of 1 to 2 oz. per bird per day. This level of greenfeed will ensure that the eggs have bright-coloured yolks.

Fig. 7.—White Leghorn hen

In these rations whalemeal has been used as a source of animal protein. Should meatmeal with a protein content of 50 per cent. be used, 6 lb. of meatmeal should be substituted for 5 lb. of whalemeal which normally contains 60 per cent, of protein.

The method of feeding adopted by the householder is a matter of personal choice, but the dry feed method where the mash is before the birds through the day in a trough will be found very convenient.

The "mash-grain" system of feeding is also very satisfactory. For laying birds, a trough containing a 20 per cent. protein mash is placed before the birds at all times, and 2 oz. of wheat per bird is fed to the fowls at some time during the day, usually in the evening.

Fig. 8.—First Cross hen

Another method widely used by householders, is the wet mash system of feeding. In addition to the dry mash, wet mash is fed to the birds in the morning and grain in the evening. While this method of feeding is quite successful, it loses the advantage of the dry mash system where the birds can be fed then left over a weekend, without calling in your neighbour.

Generally speaking, whatever feeding method is adopted should be adhered to throughout the life of the birds. Where a change is unavoidable it should be made gradually over a period of several weeks, as sudden changes often result in a drop in egg production.

Suitable grit is important in aiding the digestion of the birds and a supply of ¼in. screened blue-metal should be available at all times.

Further information on poultry feeding can be obtained from the Poultry Branch of the Department of Agriculture.

**Use of House Scraps as a Food Supplement.**

Most householders like to supplement their poultry feed with the scraps left over from the table. It must be pointed out however, that careless use of these scraps can prove costly.

All house scraps must be boiled thoroughly before feeding them to the birds and should be incorporated in a wet mash, using the liquid from the scraps to dampen the mash. This procedure immediately creates additional management problems such as having to feed the birds before hurrying off to work, and making sure that the mash is all eaten and not left around to attract flies. It also cancels out the advantage of being able to leave the poultry for two or three days at a time as is possible with dry mash feeding.

Hens can easily become affected with botulism if they eat decaying food scraps. This is a type of poisoning which usually proves fatal.

**The Importance of Vitamin A.**

An adequate Vitamin A intake is necessary to keep the birds in good health. It increases the bird's resistance to many infectious diseases, and above all, it encourages good egg production.

If prepared mashes are bought, it is advisable to purchase those which are already fortified with this important vitamin. Some prepared mashes are fortified with Vitamin A; some are not, so this point requires watching.

The supplement used for chickens from day-old to seven weeks should contain Vitamin A and D3, whereas older chickens and adult fowls usually have access to adequate sunlight and therefore need only Vitamin A fed to them.

Another source of Vitamin A is greenfeed. Greenfeed contains carotene and this, when consumed by the bird, is converted to Vitamin A. Certain plants con-

tain more carotene than others, and the younger the plant the higher its carotene content. Old fibrous plant material has a very low carotene content.

A deficiency of Vitamin A results in poor growth and development, and encourages infections, particularly in the eye, upper respiratory tract, the intestines and kidneys. Vitamin A is stored in the liver and when the reserve of this vitamin is depleted through faulty feeding, several weeks elapse before any clinical symptoms can be observed. In severe cases of Vitamin A deficiency hundreds of pustules the size of a pin's head, develop on the wall of the gullet, and the eyes discharge and become covered with a white film. This film appears as a false eyelid that reaches out over the eye from the inside corner, and in the early stages is most noticeable when the bird blinks.

Vitamin A deficient birds are most susceptible to respiratory diseases such as fowl pox, coryza and infectious laryngotracheitis. Should any of these diseases put in an appearance in a flock, which is suffering from a Vitamin A deficiency, the mortality rate can be extremely high.

*(To be continued.)*

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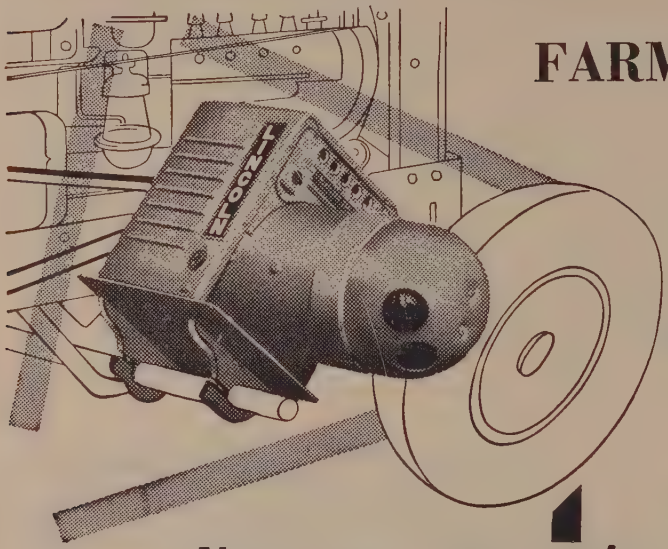


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# Weight Trends In Fattening Cattle—*continued*

## Six Years' Trials at Wokalup Research Station

By M. CULLITY, Superintendent of Dairying

### GENERAL DISCUSSION

**ALL groups in Projects 1, 2 and 3 and the groups on unirrigated pasture in Project 4, have shown a similarity in seasonal growth trends. There was an actively growing period from about June to December or January in each year. For the remainder of the year weights either remained relatively constant or losses were incurred. In this discussion, reference will be made to these periods, as the "actively growing" and the "static or losing" periods.**

The movement in average weight from the previous weighing and also the average movement per beast per day for each period of 28 days, is shown in the tables published earlier. From this and preceding information, it will be apparent that there is a close relationship between the movement in weight and the season of the year which controls the volume and quality of paddock feed. Highest gains were recorded during the spring months, when gains of up to and more than 3 lb. per day have been recorded. See Project 3, Group (A)—weighing August 27, 1953: Group (B) December 17, 1953: Group (C) December 17, 1953: Project 4 Group (A) October 21, 1954: Group (C) November 18, 1954: Project 5 Groups A and B September 27, November 17 and December 15, 1955: Group C December, 1955: Group D December, 1955: Group E September 27, November 17 and December 15, 1955.

In the summer months under dry pasture conditions, when the quantity of herbage ingested and its quality were obviously insufficient for maintenance requirements, considerable losses in weight have occurred amounting in one case at least, to 1.25 lb. per day. (See Project 3, Group (A) May 7, 1953.) Heavy apparent losses have occurred early in winter also but possibly have been due to lack of "fill" following grazing on very sappy pasture.

The average growth rates for the various periods described as "static and losing" and "actively growing," are given in Table A. Further information on the rate of gain is given in Table B where the movement over 12 months has been recorded. This method has been adopted in order to present a composite picture of the total gain over the four seasons of the year, taking into account both the actively growing period and those months when growth is either static or weight is being lost. From this it will be seen that on unirrigated pasture, the highest growth rate was obtained with Group B of Project 3, which increased by 473 lb. in the 12 months from 20/12/51 to 19/12/52.

Comparisons between the growth rates of groups in different projects are not reliable, because of differences in the breed, age and quality of the cattle and particularly because of varying seasonal conditions. While these have not affected the trend of weight gain within each year, it is probable that they have had an influence on the amount of gain. It is likely

also that differences in management have contributed to differences in the rapidity with which the animals gained weight.

As this investigation was to record growth trends under existing methods of management, no attempt was made to lay down a regimen for the manager of the property. The cattle were grazed in such paddocks for such periods as the season and the condition of the grazing in his judgment, warranted. While the very satisfactory gains which have been achieved with all groups in all projects reflect credit on the manager, it is possible to note changes in weight movement which, while they obviously were due directly to the amount and quality of the natural intake, may have been indirectly due to decisions made according to his judgment.

Thus in the season 1953-54 when the first groups had access to irrigated pasture, the rate of growth was not as high as expected nor as high as achieved in the two succeeding summers. This may have been due to a reduced intake of pasture consequent on grazing too many cattle for too long in each paddock. For the whole of the irrigation season 108 head of various ages were grazed in four paddocks totalling 33 acres. It seems probable in retrospect, that the intake per beast declined rapidly after the first few days in each paddock, even though the pastures always appeared to have ample growth, and were never grazed bare.

Another instance where it seems probable that a decision in management affected comparative growth, was after abnormal rains in February 1955, when the cattle intended for dry land summer grazing were grazed on flat land carrying a good cover of couch. This responded quickly to the rain so that the pasture quickly lost the character of a normal unirrigated (dryland) pasture of the summer months.

On other occasions when the movement in weight was lower than expected, there seemed the possibility that the intake from the grazing selected was insufficient.

In June and July of 1952, the cattle were given access to a large area of green oats. The following weighing showed a substantial loss in weight. The record of movement of the cattle showed rapid changes over a few days on to oats and back to other pasture. It seemed that the loss of weight could have been due to the animals carrying less fill in the gut at weighing time, and there also was the possibility that digestive upsets due to several rapid changes of diet contributed.

Other illustrations suggesting the influence of management both in achieving high and low gains, could be cited. The above comments are speculative only, but with great weight of evidence in support. **If the conclusions are correct, the instances stress the need for fattening animals to have continuous access to ample feed of proper quality and of avoiding sudden changes in the character of the diet.**

When irrigated pastures became available it was possible demonstrate their value in promoting continuous growth during the period described as the "static or losing" period for cattle on unirrigated pasture.

## DAIRY BREEDS OF STEERS

During the six years a number of groups of steers of dairy breeds have been included because of the obvious importance of such animals in supplying beef to the people of Perth and the towns of agricultural areas of this State, and also because in the preliminary stages it was more convenient to use them than to purchase stock of the specialised beef breeds for the purpose. The results show that as indicator animals they have been successful, inasmuch as the trend in weight gain throughout a year is parallel for all classes of cattle and obviously is a direct reflection of the food consumed.

In Project 1, dairy steers only were used. Figure 1 shows the trend of growth for the individual animals. The general movement is similar for all except a few which were not in normal health. The curves for each of the breeds and the cross-breds are similar. There were some differences in the rate of gain in the spring and the amount of loss in the autumn, but the general movement of weight for all healthy animals was in the same direction.

Thirty steers were weighed from October 30 to December 19, 1950. The number was increased to 35 at the January 23 weighing, when there were 13 A.I.S., 15 Jersey, and 7 Guernsey or their crosses.

In the 49 days from October 30 to December 19, the 30 animals increased by 105 lb. or 2.14 lb. per day.

The relative weight movements of the breeds is shown hereunder:—

| | 23–1–51 to 15–5–51 | | 15–5–51 to 17–1—52 | | 23–1–51 to 17–1–52 | |
|---|---|---|---|---|---|---|
| | 112 days. | Per day. | 247 days. | Per day. | 359 days. | Per day. |
| A.I.S. and Crosses .... .... | — 107 | — 0·43 | + 390 | + 1·59 | + 283 | + 0·78 |
| Jersey and Crosses .... .... | — 68 | — 0·27 | + 307 | + 1·24 | + 239 | + 0·66 |
| Guernsey and Crosses .... .... | — 100 | — 0·40 | + 297 | + 1·20 | + 197 | + 0·55 |

In Project 2, four separate groups were studied, although the numbers in those groups were small. The results are summarised as under, showing average weight movements in each period and the average movement per day:—

| Group. | 27–9–51 to 20–12–51 Weight change. (lb.) | | 20–12–51 to 5–6–52 Weight change. (lb.) | | 5–6–52 to 15–1–53 Weight change. (lb.) | | 27–9–51 to 15–1–53 Weight change. (lb.) | |
|---|---|---|---|---|---|---|---|---|
| | 84 days. | Per day. | 168 days. | Per day. | 224 days. | Per day. | 476 days. | Per day. |
| B.—40 A.I.S. 1950 .... .... | + 174 | + 2·07 | + 22 | + 0·11 | + 470 | + 2·09 | + 666 | + 1·40 |
| C.—6 mixed 1949 .... .... | + 127 | + 1·51 | — 40 | — 0·23 | + 322 | + 1·44 | + 409 | + 0·85 |
| D.—5 mixed 1950 .... .... | + 132 | + 1·57 | — 4 | .... | + 408 | + 1·82 | + 536 | + 1·12 |
| E.—6 mixed 1951 .... .... | + 144 | + 1·71 | — 52 | — 0·31 | + 397 | + 1·77 | + 593 | + 1·24 |

As groups C, D, E, contained small numbers of mixed breed, the individual weight movements are given.

| Description. | 27–9–51 to 20–12–51 84 days. | 20–12–51 to 5–6–52 168 days. | 5–6–52 to 15–1–53 224 days. | 27–9–51 to 15–1–53 476 days. |
|---|---|---|---|---|
| | lb. | lb. | lb. | lb. |
| C. | | | | |
| Guernsey .... .... .... .... | + 134 | — 80 | + 328 | + 382 |
| Fawn Jersey .... .... .... | + 142 | — 122 | + 480 | + 500 |
| Fawn Jersey .... .... .... | + 130 | — 26 | + 344 | + 448 |
| Brown and white .... .... | + 108 | — 64 | + 270 | + 314 |
| Strawberry Jersey X .... .... | + 152 | — 20 | + 384 | + 516 |
| Dark Brindle Poll .... .... | + 94 | — 42 | + 226 | + 276 |
| D. | | | | |
| Whole Colour Jersey .... .... | + 102 | + 50 | + 362 | + 514 |
| Whole Colour Jersey .... .... | + 148 | + 10 | + 460 | + 618 |
| Guernsey .... .... .... .... | + 126 | — 6 | + 328 | + 448 |
| Guernsey .... .... .... .... | + 142 | — 6 | + 390 | + 528 |
| E. | | | | |
| Guernsey .... .... .... .... | + 148 | + 56 | + 422 | + 626 |
| Jersey .... .... .... .... | + 124 | + 30 | + 414 | + 568 |
| A.I.S. .... .... .... .... | + 166 | + 50 | + 450 | + 666 |
| A.I.S. .... .... .... .... | + 136 | + 52 | + 416 | + 594 |
| A.I.S. .... .... .... .... | + 144 | + 50 | + 342 | + 536 |
| A.I.S. .... .... .... .... | + 150 | + 70 | + 400 | + 620 |
| Average 4 A.I.S. .... .... .... | + 149 | + 55 | + 402 | + 604 |

In Projects 3, 4 and 5, A.I.S. steers were the only representatives of the dairy breeds. Their performances were as under:—

| Project and Group. | No. of Steers and breed. | Period. | Gain. | | |
|---|---|---|---|---|---|
| | | | Days. | Period. | Per day. |
| | | | | lb. | lb. |
| 3 B. .... .... .... | 30 A.I.S. .... .... | 4-6-53 to 14-1-54 | 224 | + 453 | + 2·02 |
| 4 D. .... .... .... | 14 A.I.S. .... .... | 3-6-54 to 13-1-55 | 224 | + 342 | + 1·52 |
| | | 13-1-55 to 2-6-55 | 140 | + 66 | + 0·47 |
| 5 B. .... .... .... | 12 A.I.S. .... .... | 30-6-55 to 12-1-56 | 196 | + 384 | + 1·96 |
| | | 12-1-56 to 31-5-56 | 140 | + 94 | + 0·69 |
| 5 E. .... .... .... | 16 A.I.S. .... .... | 4-7-55 to 12-1-56 | 192 | + 406 | + 2·11 |
| | | 12-1-56 to 31-5-56 | 140 | + 126 | + 0·88 |

A study of the figures in the foregoing tables shows that generally in the periods when pasture was known to be adequate (June-January), satisfactory rates of growth were achieved.

The A.I.S. steers recorded more rapid gains than the other breeds, although excellent gains were recorded for individual animals described as Jersey and Guernsey.

The average gain of 129 A.I.S. cattle in all projects during the actively growing period was 411 lb. compared to 328 lb. for 23 Jerseys and 322 lb. for 11 Guernseys.

## HEREFORD CROSS STEERS FROM DAIRY COWS

The opportunity of studying the performance of progeny by Hereford bulls from reject dairy cows was a valuable one in view of the demonstrations being given at the Wokalup property and the Pardelup Prison Farm in grading up to a Hereford herd from a foundation of reject dairy cows. Over the latter part of the period being discussed, an increasing number of cross-bred steers became available and some useful comparative data has been accumulated. In all, 161 such animals have been included in Projects 2, 3, 4 and 5, for an average gain in the active growing period of 367 lb. It is noteworthy that the average gain of all A.I.S. animals as reported in the previous section, was 411 lb.

A summary of the performance of the various groups with a comparision with dairy groups was possible, as follows:—

**Project 2.**

Eleven Hereford Cross gained 454 lb. or 2.02 lb. per day from June 5, 1952, to January 15, 1953, while 33 station Shorthorns gained 476 lb. or 2.12 lb. per day, and 40 A.I.S. 470 lb. or 2.11 lb. per day. The other groups of dairy steers made less rapid gains.

**Project 3.**

Thirty-five Hereford Cross born 1951-52 at Wokalup, gained 381 lb. or 1.7 lb. per day and 20 Hereford A.I.S. cross born 1952 at Pardelup gained 417 lb. or 1.81 lb. per day.

Twenty A.I.S. steers from Pardelup born 1952, in the same time increased by 453 lb. or 2.02 lb. per day.

**Project 4.**

Eighteen Hereford cross born 1953, in the actively growing period gained 298 lb. at a rate of 1.33 lb. per day while 14 A.I.S. put on 342 lb. or 1.52 lb. per day.

These animals were on unirrigated pasture during the previous summer.

A group of 18 Hereford cross of the same age which were in irrigated pasture in the summer, gained 358 lb. or 1.60 lb.

Another group of Hereford cross one year older, which also were on irrigated pasture in summer, put on 368 lb. or 1.64 lb. per day.

During the summer months the groups of Hereford cross and A.I.S. animals each gained 53 lb. or 0.47 lb. per day.

**Project 5.**

A direct comparison between A.I.S. and Hereford cross cattle at two ages was possible. All groups were on irrigated pasture in summer. There was also a small group of 5 Aberdeen Angus cross.

The two groups of Hereford cross increased weight by 365 lb. and 337 lb. (1.86 lb. and 1.72 lb. per day), in the winter-spring period, and by 137 lb. and 194 lb. (1.22 lb. and 1.73 lb. per day) in the summer.

These were very satisfactory gains but were more than matched by the A.I.S., which in the same periods put on 384 lb. and 406 lb. (1.95 and 2.07 lb. per day) and 139 lb. and 157 lb. (1.24 lb. and 1.40 lb. per day) respectively.

The total increases in the project extending over 300 days for these four groups were—

Group A.—18 Hereford Cross 1953. 308 days. 502 lb.

Group B.—14 A.I.S. 1953. 308 days. 523 lb.

Group C.—24 Hereford Cross 1954. 304 days. 531 lb.

Group E.—16 A.I.S. 1954. 304 days. 563 lb.

In the same period the small group of of Aberdeen Angus gained 578 lb.

It is of value to record that all Hereford cross and A.I.S. steers grew at satisfactory rates in contrast to the other dairy steers a few of which failed to fatten readily. The evidence however, suggests this may have been accentuated by individual weaknesses and not wholly to the characteristics of the breeds.

From the data therefore, it is clear that the A.I.S. grew at least as rapidly as the Hereford cross steers. As indicated earlier, there was a marked preference by butchers for the beef cross animals indicated by their offering a higher price per pound. This undoubtedly is due to the more attractive butchering characteristics of the more fleshy beef animals. Unfortunately, it was not practicable to make comparative appraisals of the carcases of the two classes of animals.

## VALUE OF IRRIGATED PASTURE

The growth trends disclosed by Projects 1, 2 and 3 showed a lag period during summer and autumn of up to six months and therefore in an irrigation district, the most logical method of avoiding this is to allow the cattle access to irrigated pasture during this period. In Projects 4 and 5 this was done with greatly improved results.

However, only in Project 4 was a direct comparison made of growth rates from irrigated and unirrigated pasture in the same season. As pointed out in the report on this project there were unusual circumstances due to:—

(a) Abnormal seasonal conditions, i.e., over six inches of rain fell in February, 1954, leading to excellent growth from some unirrigated paddocks, and

(b) a too heavy concentration of cattle on the irrigated pasture.

Nevertheless the yearling Hereford dairy cross steers on irrigated paddocks put on 133 lb. more than those on unirrigated pasture, the respective weight gains being 186 lb. and 53 lb. respectively.

In Project 5, 72 head were kept on irrigated pasture throughout the summer and gained 162 lb. at a rate of 1.45 lb. per day in 112 days.

These cattle included steers by Hereford and Aberdeen-Angus bulls from dairy cows and of Australian Illawarra Shorthorn breeding.

The gain in weight of the various groups comprising the 72 head is shown in the table which has been designed to show the gross weight gain or loss of all cattle in all projects which have been weighed during the summer months.

The periods in each year do not coincide precisely as to dates, but extend in each case from the December to the following April weighing.

IRRIGATED *v.* UNIRRIGATED PASTURE.
COMPARISON OF WEIGHT CHANGES IN STEERS.
112 Day Period Summer-Autumn.

| UNIRRIGATED PASTURE. | | | IRRIGATED PASTURE. | | |
|---|---|---|---|---|---|
| Project. | Group. | Weight Change (lb.) | Project. | Group. | Weight Change (lb.) |
| 1 | 35 dairy—mixed .... .... | — 89 | 4 1954 | 23 Hereford Cross dairy 1952 | + 19 |
| 2 | 33 Station shorthorns .... .... | + 35 | 1955 | 23 Hereford Cross dairy .... | + 125 |
| | 40 dairy mixed .... .... .... | + 29 | 1954 | 18 Hereford Cross dairy 1953 | + 62 |
| | 6 dairy mixed 1949 .... .... | — 10 | 1955 | | + 186 |
| | 5 dairy mixed 1950 .... .... | + 29 | 5 | 18 Hereford Cross dairy 1953 | + 137 |
| | 6 dairy mixed 1951 .... .... | + 38 | | 21 Hereford Cross dairy 1954 | + 194 |
| | 4 Hereford Cross dairy .... | — 21 | | 5 Angus Cross dairy 1954 .... | + 193 |
| 3 | 24 Hereford Cross dairy .... | — 71 | | 12 A.I.S. 1953 .... .... .... | + 139 |
| | 24 Hereford Cross dairy .... | — 21 | | 16 A.I.S. 1954 .... ... .... | + 157 |

The average loss of the 177 cattle kept on unirrigated pasture was 16 lb., while the average gain of the 154 on irrigated pasture was 126 lb.—a difference of 142 lb. in favour of the latter.

The rate of growth on irrigated pasture up to this stage has not been as great as that on annual type pastures in the spring. This is probably related to the concentration of stocking which is still much heavier on the irrigated pasture at a level of approximately two head per acre for the whole of the irrigation season.

Observations on the value of irrigated versus unirrigated pasture are being continued.

## AGE

While cattle of all ages from six months to four years were included in one or other of the various projects, no specific attempt at age comparisons was made. However, an examination of the data suggests a more rapid growth of yearlings than older animals.

The only direct comparisons possible are between groups of Hereford cross one year different in age in Projects 4 and 5, and of groups of A.I.S. in Project 5. There was no regularity of seasonal growth differences for these groups, but over the whole period of the projects the younger animals were recorded as having made greater growth. For example, in Project 4, 23 Hereford cross growing from two to three years of age gained 512 lb. in 448 days, whilst 18 animals of similar breeding but one year younger gained 606 lb. These animals were grazed together as the one group throughout the period. In Project 5, 18 Hereford cross growing from two to three years of age gained 502 lb. in 448 days. Twenty-four of similar breeding and kept under exactly the same conditions, but one year younger in age, gained 521 lb. In the same project, two groups of A.I.S. also one year different in age, showed a difference in growth of 40 lb. (563 to 523 in favour of the younger animals in the same period.)

## CLIMATIC INFLUENCE

The high degree of regularity of the climate is reflected in the uniformity of the trends in weight gain of the various groups of animals kept on unirrigated pasture.

The only notable variation was the abnormal rain of February 1955, causing an excellent quick growth of pasture (couch and perennial rye grass) and increased weights of the cattle in March and April.

## SOURCES OF STOCK

The source of the cattle had no bearing on the trend of weight movement. Cattle from several sources were used, viz. bred on the Wokalup property, transferred from Pardelup, purchased from south-western farmers, purchased from a north-west draft, transferred from the Claremont Mental Hospital.

## GENERAL

The decision in this phase of the co-ordinated plan of investigation in the southern states of Australia to first determine normal trends of growth, has been proved wise in these trials.

The outstanding result of the work in the first three years is the demonstration of the long period when animals are held and no gains in weight occur. Obviously it is undesirable to keep cattle intended

Table A

COMPARATIVE GROWTH RATES OF ALL GROUPS

| Project. | Group. | Period. | Days. | Average Gain or Loss ± lb. per Beast. | | | |
|---|---|---|---|---|---|---|---|
| | | | | Static or Losing Period. | | Growing Period. | |
| | | | | Per period. | Per day. | Per period. | Per day. |
| 1 | A.—30 Dairy Steers .... .... | 31–10–50 to 19–12–50 | 49 | .... | .... | + 105 | + 2·14 |
| | B.—35 Dairy Steers .... .... | 19–12–50 to 15–5–51 | 147 | — 100 | — 0·67 | .. | .... |
| | C.—35 Dairy Steers .... .... | 15–5–51 to 20–12–51 | 219 | .... | .... | + 348 | + 1·59 |
| 2 | A.—33 Station Steers .... .... | 29–9–51 to 20–12–51 | 84 | .... | .... | + 152 | + 1·8 |
| | | 20–12–51 to 5–6–52 | 168 | — 40 | — 0·25 | .. | .. |
| | | 5–6–52 to 15–1–53 | 224 | .... | .... | + 476 | + 2·12 |
| | B.—40 Mixed Dairy S.W. .... | 29–9–51 to 20–12–51 | 84 | .... | .... | + 174 | + 2·1 |
| | | 20–12–51 to 5–6–52 | 168 | + 22 | + 0·12 | .... | .. |
| | | 5–6–52 to 15–1–53 | 224 | .... | .... | + 470 | + 2·11 |
| | C.—6 Dairy (4 yr. old) .... | 27–9–51 to 20–12–51 | 84 | .... | .... | + 127 | + 1·5 |
| | | 20–12–51 to 5–6–52 | 168 | — 40 | — 0·25 | .... | .... |
| | | 5–6–52 to 15–1–53 | 224 | .... | .... | + 322 | + 1·44 |
| | D.—5 Dairy Steers 1950 .... | 27–9–51 to 20–12–51 | 84 | .... | .... | + 132 | + 1·57 |
| | | 20–12–51 to 5–6–52 | 168 | — 4 | — 0·02 | .. | .... |
| | | 5–6–52 to 15–1–53 | 224 | .... | .... | + 408 | + 1·82 |
| | E.—6 Dairy Steers 1951 .... | 27–9–51 to 20–12–51 | 84 | .... | .... | + 144 | + 1·72 |
| | | 20–12–51 to 5–6–52 | 168 | + 52 | + 0·30 | .... | .... |
| | | 5–6–52 to 15–1–53 | 224 | .... | .... | + 397 | + 1·77 |
| | F.—11 Hereford X 1951 .... | 27–9–51 to 20–12–51 | 84 | .... | .... | + 174 | + 2·07 |
| | | 20–12–51 to 5–6–52 | 168 | + 14 | + 0·08 | .... | .... |
| | | 5–6–52 to 15–1–53 | 224 | .... | .... | + 454 | + 2·02 |
| | A.–F.—105 Steers .... .... | 27–9–51 to 20–12–51 | 84 | .... | .... | + 159 | + 1·9 |
| | | 20–12–51 to 5–6–52 | 168 | — 2 | — 0·012 | .... | .... |
| | | 5–6–52 to 15–1–53 | 224 | .... | .... | + 485 | + 2·0 |
| 3 | A.—35 Hereford X Dairy Wokalup | 12–2–53 to 4–6–53 | 112 | — 35 | — 0·3 | .... | .... |
| | | 4–6–53 to 14–1–54 | 224 | .... | .... | + 381 | + 1·7 |
| | B.—30 A.I.S. 1952 Pardelup .... | 4–6–53 to 14–1–54 | 224 | .... | .... | + 453 | + 2·02 |

Table A—*continued*

COMPARATIVE GROWTH RATES OF ALL GROUPS—*continued*

| Project. | Group. | Period. | Days. | Average Gain or Loss ± lb. per Beast. | | | |
|---|---|---|---|---|---|---|---|
| | | | | Static or Losing Period. | | Growing period. | |
| | | | | Per period. | Per day. | Per period. | Per day. |
| | C.—20 Hereford X A.I.S. 1952 Pardelup | 4–6–53 to 14–1–54 | 224 | .... | .... | + 417 | + 1·81 |
| 4 | A.—23 Hereford X 1952 on Irrigation 1954/5 | 11–2–54 to 3–6–54 | 112 | + 19 | + 0·17 | .... | .... |
| | | 3–6–54 to 13–1–55 | 224 | .... | .... | + 368 | + 1·64 |
| | | 13–1–55 to 5–5–55 | 112 | + 125 | + 1·11 | .... | .... |
| | B.—18 Hereford X 1953 on Irrigation 1954/5 | 12–2–54 to 3–6–54 | 112 | + 62 | + ·55 | .... | .... |
| | | 3–6–54 to 13–1–55 | 224 | .... | .... | + 358 | + 1·60 |
| | | 13–1–55 to 5–5–55 | 112 | + 186 | + 1·66 | .... | .... |
| | C.—18 Hereford X 1953 Dryland | 11–2–54 to 3–6–54 | 112 | — 11 | — 0·1 | .... | .... |
| | | 3–6–54 to 13–1–55 | 224 | .... | .... | + 298 | + 1·33 |
| | | 13–1–55 to 5–5–55 | 112 | + 53 | + 0·47 | .... | .... |
| | D.—14 A.I.S. 1953 Dryland .... | 11–2–54 to 3–6–54 | 112 | + 15 | + 0·13 | .... | .... |
| | | 3–6–54 to 13–1–55 | 224 | .... | .... | + 342 | + 1·52 |
| | | 13–1–55 to 5–5–55 | 112 | + 53 | + 0·47 | .... | .... |
| 5 | A.—18 Hereford X 1953 .... | 30–6–55 to 12–1–56 | 196 | .... | .... | + 365 | + 1·86 |
| | | 12–1–56 to 3–5–56 | 112 | + 137 | + 1·22 | .... | .... |
| | B.—12 A.I.S. 1953 .... .... | 30–6–55 to 2–1–56 | 196 | .... | .... | + 384 | + 1·95 |
| | | 12–1–56 to 3–5–56 | 112 | + 139 | + 1·24 | .... | .... |
| | C.—24 Hereford X 1954 .... | 4–7–55 to 12–1–56 | 196 | .... | .... | + 337 | + 1·72 |
| | | 12–1–56 to 3–5–56 | 112 | + 194 | + 1·73 | .... | .... |
| | D.—5 Aberdeen Angus 1954 | 4–7–55 to 12–1–56 | 196 | .... | .... | + 325 | + 1·65 |
| | | 12–1–56 to 3–5–56 | 112 | + 193 | + 1·72 | .... | .... |
| | E.—16 A.I.S. 1954 .... .... | 4–7–55 to 12–1–56 | 196 | .... | .... | + 406 | + 2·07 |
| | | 12–1–56 to 3–5–56 | 112 | + 157 | + 1·40 | .... | .... |
| | F.—20 Hereford X 1955 .... | 9–2–56 to 3–5–56 | 84 | + 127 | + 1·51 | .... | .... |

for fattening for several months with no gain in weight, if there is any economic way in which the animals can be made to grow. Lost time is equivalent to lost money.

It is hoped that later work will demonstrate the usefulness and economy of supplementary feeding, while already the value of irrigation pasture has been demonstrated.

It seems obvious that in any programme of supplementary feeding, that feeding commence prior to any fall in weight, not only to ensure that the start is not made after animals commence to lose condition, but to avoid the physiological changes leading to a loss of weight which commence prior to the loss being discernible.

The value of irrigated pasture in promoting growth in the summer months and so allowing continuous growth throughout the year has been demonstrated. The use of irrigated pasture in this way has the additional advantage of allowing the farmer to market his fat stock at a period of the year when prices are more favourable. The farmer thus gains twice, in having heavier beasts to sell at a higher price. Further, it helps him to market animals some months earlier for the same weight by avoiding the lag which occurs on dry pasture. By selling earlier, it also allows more cattle to be handled in a given time. There thus are several advantages to the use of irrigated pastures in this way.

Table B

TWELVE MONTHS' GROWTH

| Project. | Group. | Period. | Days. | Gain. lb. |
|---|---|---|---|---|
| 1 | 35 Dairy Steers .... .... .... .... .... .... | 19–12–50<br>20–12–51 | 366 | + 248 |
| 2 | 105 Mixed .... .... .... .... .... .... .... | 20–12–51<br>18–12–52 | 363 | + 434 |
| | A.—33 Station .... .... .... .... .... .... | 20–12–51<br>18–12–52 | .... | + 409 |
| | B.—40 Dairy .... .... .... .... .... .... | 20–12–51<br>18–12–53 | .... | + 473 |
| | C.—6 Dairy 1949 .... .... .... .... .... .... | 20–12–51<br>18–12–52 | .... | + 264 |
| | D.—5 Dairy 1950 .... .... .... .... .... .... | 20–12–51<br>18–12–52 | .... | + 390 |
| | E.—6 Dairy 1951 .... .... .... .... .... .... | 20–12–51<br>18–12–52 | .... | + 435 |
| | F.—11 Hereford X Dairy .... .... .... .... | 20–12–51<br>18–12–52 | .... | + 455 |
| 3 | 36 Mixed Pardelup .... .... .... .... .... | .... | .... | + 328 |
| 4 | A.—23 Hereford X 1952 on Irrigation in summers of 1953/4 and 1954/5 | 11–2–54<br>10–2–55 | .... | + 442 |
| | | 6–5–54<br>5–5–55 | .... | + 467 |
| | B.—18 Hereford X 1953 on Irrigation in summers of 1953/4 and 1954/5 | 11–2–54<br>10–2–55 | 364 | + 473 |
| | | 6–5–54<br>5–5–55 | 364 | + 542 |
| | C.— (i) 18 Hereford X 1953. Dry pasture in Summer | 11–2–54<br>10–2–55 | 364 | + 310 |
| | (ii) On unirrigated but rain stimulated pasture Summer 1954/5 | 10–2–55<br>9–2–56 | 364 | + 486 |
| | | 6–5–54<br>5–5–55 | 364 | + 344 |
| | (iii) On irrigated pasture Summer 1955/6 .... | 5–5–55<br>3–5–56 | 364 | + 495 |
| | D.— (i) 14 A.I.S. 1953. Dry pasture in Summer .... | 11–2–54<br>10–2–55 | 364 | + 386 |
| | (ii) On unirrigated but rain stimulated pasture Summer 1954/5 | 10–2–55<br>9–2–56 | 364 | + 451 |
| | | 6–5–54<br>5–5–55 | 364 | + 401 |
| | (iii) On irrigated pasture Summer 1955/6 .... | 5–5–55<br>3–5–56 | 364 | + 538 |

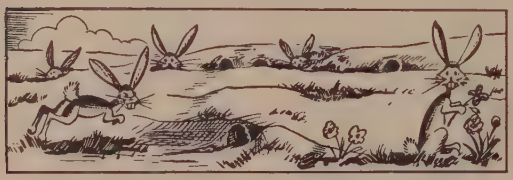
**ACKNOWLEDGMENT**

Special thanks are extended to Messrs. K. W. Simes, Manager of the Research Station and to Mr. K. Hope, Agricultural Adviser.

Mr. Simes gave continuous assistance in the selection, marking and weighing the cattle, in recording observations on climatic, pasture, and stock conditions, and by directing his farm staff in their duties in these trials, for which they are also thanked.

Mr. Hope has been closely associated with recording the details of the work in this office.

The assistance of other officers who have from time to time been associated with the work, is also acknowledged.



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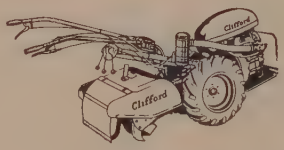
## ROTARY CULTIVATORS

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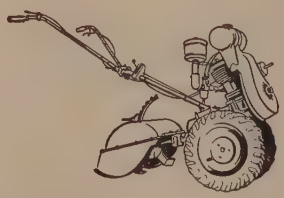

**MARK I**

This 1½ H.P. Machine has been proved and tested for inter row cultivation also is a great advantage to the home gardener. It features 2 Speed Gear Box. 12 inch width rotary cultivator which can be mounted forward as well as rear, thus enabling cultivation under trees, vines or shrubs.

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# L. H. RAWLING

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Fig. 1.—A photograph of the stone roller in use.

# STONE ROLLER AS MOWING AID

By R. L. DOWN, Manager, Avondale Research Station

**THE Avondale Research Station is situated on land typical of many thousands of acres of the Avon Valley—jam, wattle and York-gum country liberally dotted with stony outcrops. Despite the expenditure over the years of many man-hours on stone-picking, the cutting of meadow hay was always a task involving frayed tempers, loss of time and a heavy bill for replacements of mower parts. Small stones, which were of no consequence in the working of a paddock with other types of machinery, jammed the mower knives with exasperating frequency.**

It was not a practicable proposition to make hundreds of acres entirely stone-free, so following upon consultations with experienced farmers and engineers it was decided to test a heavy roller to press the stones into the ground before mowing, and incidentally to level out minor irregularities on the soil surface.

A roller was constructed of $\frac{5}{8}$ in. steel plate, welded in cylindrical form and ground smooth over the weld. The roller was 9 ft. in length and 3 ft. in diameter. The ends were two circles of $\frac{3}{4}$ in. plate, fillet-welded into the ends of the cylinder, and these carried two 2 in. diameter stub-axles welded and strengthened into the centres of the circles. One of the roller ends was fitted with a $1\frac{1}{2}$ in. gas plug to enable the cylinder to be filled with water.

The stub axles were fitted into sawbench-type bearings, the construction of which enabled them to withstand side-thrust, and these bearings were bolted to a 4 in. channel-steel frame. The weight of the implement was $1\frac{1}{2}$ tons dry and 3 tons when water-filled.

## SUCCESSFUL OPERATION

The roller was delivered at Avondale at the end of June and given a thorough trial. It exceeded all expectations in operation, being easily handled by a light tractor and proving highly manoeuvrable — sliding round in short turns without "scuffing" or damaging the pasture growth.

The maximum (water-filled) weight was shown to be desirable and the most effective speed appeared to be 3 m.p.h.

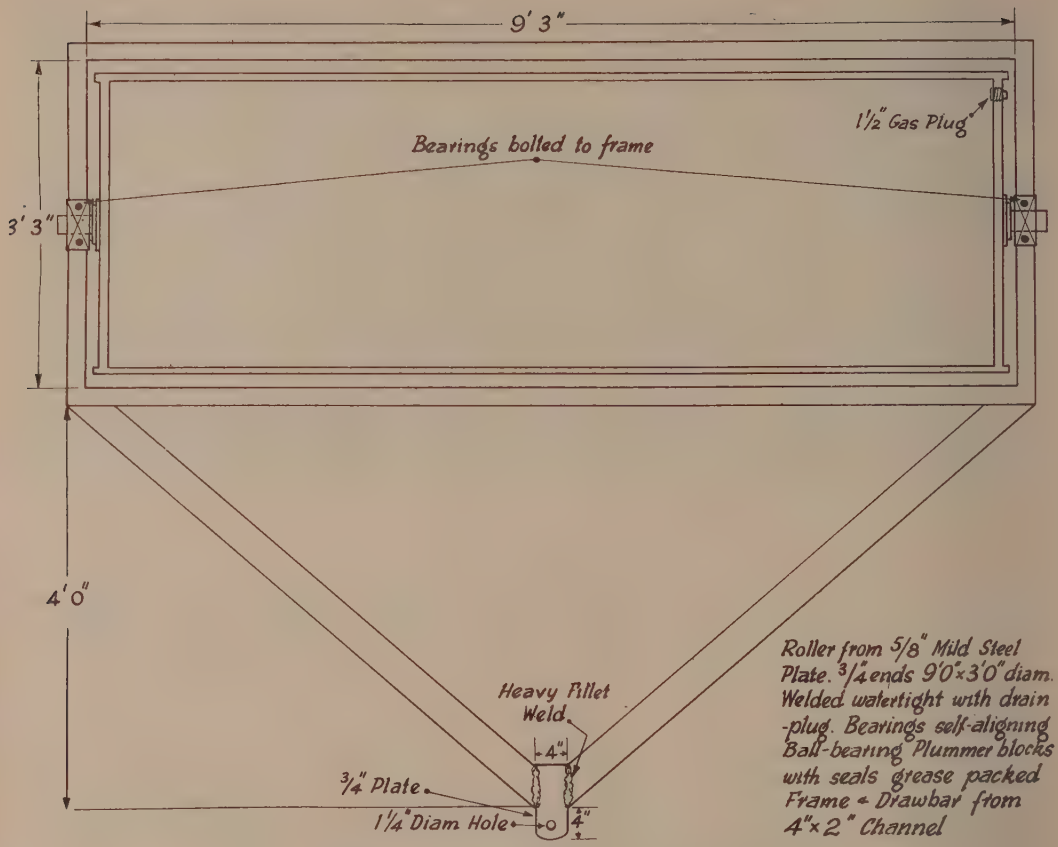
9' 3"
1½" Gas Plug
Bearings bolted to frame
3' 3"
4' 0"
Heavy Fillet Weld
4"
¾" Plate
1¼" Diam Hole
4"
Roller from 5/8" Mild Steel Plate. ¾" ends 9'0"×3'0" diam. Welded watertight with drain-plug. Bearings self-aligning Ball-bearing Plummer blocks with seals grease packed
Frame & Drawbar from 4"×2" Channel

Fig. 2.—Diagram showing constructional details of the roller.

Due to the smooth surface of the roller it could be used without scuffing, even under wet conditions.

Approximately 200 acres were rolled satisfactorily during June, July and August under varying conditions of soil moisture. Stones up to 3 in. in diameter were pressed into the ground quite easily under almost dry conditions.

Under moist conditions and active plant growth, the pressure of the roller did not appear to cause any damage to the plants. They returned to their normal positions so quickly after rolling that we considered fitting a marker to the roller. The fitting of a trailer behind the roller to dispose of any large stones encountered, made a marker unnecessary as the tyre-tracks remained visible.

The advent of a dry spell caused the pasture growth to wilt prematurely and prevented us from ascertaining how late the pasture could be effectively rolled.

Because of the dry spell it was decided to try to cut hay on a paddock which was not showing early effects of the dry weather, but had previously been regarded as hopeless for hay-cutting.

This paddock was very stony, and the ground surface was particularly rough. It was rolled in an anti-clockwise direction and then mowed "against the grain" of the rolling.

The mower guards were tilted downward and although the ground surface was very dry and the clover going down rapidly, a large quantity of hay was cut with a minimum of damage to the guards and knife sections.

From the foregoing, it will be seen that the roller can be recommended as an economical and practical approach to the

problem of increasing the areas of meadow hay cut annually. Our experience indicates that it makes mowing possible on areas previously regarded as too rough.

The cost of the roller is soon recovered in lowered mower maintenance costs, time saved, and extra hay harvested. Its simple construction makes it probable that the implement will last for many years with little or no maintenance costs.

A similar roller has now been delivered to the Esperance Plains Research Station where small roots have created difficulties when hay-cutting.


## GUERNSEY BULLS

The Muresk Agricultural College Guernsey Stud is one of the State's most outstanding herds and its average production figure for 1956-57 was 397 lb. butterfat on a mature equivalent basis. Pedigreed bulls from this herd are available for purchase by farmers.

The bulls are by such well-known sires as Muresk Air Commodore, Koojan Ace's Adjutant and Koojan Ideal's Charmer and are from dams with excellent production figures. Those at present available are aged from about nine to 15 months.

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## MURESK AGRICULTURAL COLLEGE

**(Department of Agriculture)**

Parents are reminded that applications for 1959 admission to Muresk Agricultural College close on 31st December of this year. A preliminary selection of 1959 entrants is made after the Junior results are available in January, 1958.

The successful applicants then continue with Sub-Leaving studies during 1958.

The Entrance qualifications include:—

(a) Sub-Leaving English, Mathematics A, Physics (including Magnetism and Electricity), and Chemistry.

(b) Junior Bookkeeping.

Should places still exist after the preliminary selection qualified applicants are enrolled in the order of application.

DURATION OF COURSE—Two years.

FEES—Approximately £130 per annum covering full residential charges.

SCHOLARSHIPS—Department of Agriculture (3), the "Countryman," and J. J. Poynton Memorial (2).

BOARDING ALLOWANCE—Most Muresk students are eligible for the Education Department Boarding Allowance (£50 per annum).

Full details of the College are obtainable from the Principal, Muresk Agricultural College, Muresk, W.A., or the Department of Agriculture, Perth.


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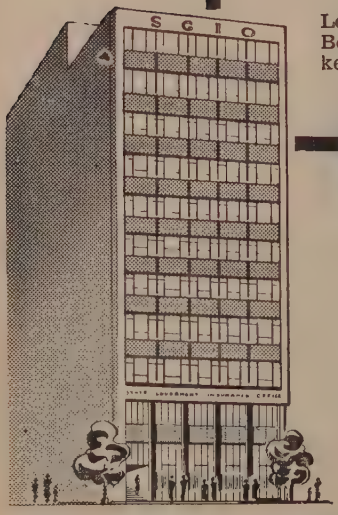


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# PRESERVATIVES AND THE NUTRITIVE VALUE OF SILAGE

By L. C. SNOOK, D.Sc., Animal Nutrition Officer

**INQUIRIES are being received concerning the value of using preservatives such as sodium metabisulphite when making silage. Encouraging reports have been published overseas concerning the effectiveness of this chemical in reducing waste and increasing the palatability of silage. The following comment is copied from the Journal of the Royal Agricultural Society of England (Volume 117, page 136, 1956).**

"During the process of making silage by the conventional method losses of nutrients are incurred by respiration of the plants after cutting. These losses continue in the silo as long as the air entrapped in the mass of ensiling material contains oxygen. Thereafter bacteria become active, with organic acids produced as the principal end product of their fermentative actions. Together, these respiratory and fementative transactions entail a considerable loss of nutrients even when conditions for silage making are ideal. They are appreciably reduced when metabisulphite is used.

"Metabisulphite acts essentially as a preservative and if it is to be fully effective the silo should be filled rapidly, the contents should be efficiently packed, and the material being ensiled should be short. Under these conditions respiration and bacterial activity are reduced, acid production is low and the resultant silage is much closer to neutrality than conventional types of silage. In most samples of metabisulphite silage no butyric acid is detectable, and in others the amounts are very low."

Many experiments have been carried out to determine just how effective are various preservatives when added to silage. The following table (from the Journal of the R.A.S.E.) indicates the losses which can occur without preservative and when sodium metabisulphite or molasses are added to material in properly-constructed tower silos.

LOSSES OF NUTRIENTS FOR SILOS FILLED WITH UNWILTED HERBAGE, DIFFERENT METHODS OF ENSILING BEING USED.

| Herbage and Method of Ensiling. | Loss of | | |
|---|---|---|---|
| | Dry Matter. | Crude Protein. | Energy. |
| Grass— | per cent. | per cent. | per cent. |
| 8lb. SMB per ton .... | 8·9 | 7·4 | 9·0 |
| No preservative .... | 11·3 | 9·6 | 8·7 |
| 80lb. molasses per ton .... | 21·7 | 21·7 | 27·3 |
| Lucerne-grass— | | | |
| 7½lb. SMB per ton .... | 12·3 | 26·3 | 10·0 |
| 10½lb. SMB per ton .... | 7·6 | 18·6 | 6·8 |
| No preservative .... | 30·6 | 34·7 | 28·2 |
| 70lb. molasses per ton .... | 17·5 | 33·0 | 14·5 |
| Lucerne— | | | |
| 9lb. SMB per ton .... | 14·8 | 18·4 | 12·9 |
| No preservative .... | 28·4 | 27·4 | 25·8 |

SMB = sodium metabisulphite.

It is apparent that the preservative does reduce loss when used in a well-made air tight silo. The magnitude of the saving is not necessarily great, however, and may be of no consequence in stack or pit silage.

Sodium metabisulphite costs about 3s. per pound in Perth. As about 8 lb. are required per ton of silage, the use of the preservative can add considerably to the cost of the conserved fodder. The sulphite has to be thoroughly mixed with the green material being ensiled. This also will increase the time and labour required to make silage. Under present conditions, therefore, it is most unlikely that the use of sodium metabisulphite in silage making will be justified.

# LIST OF REGISTERED STOCK FOODS AND STOCK LICKS, 1957-58

(By A. K. JONES, Inspector of Feeding Stuffs.)

## STOCK FOODS

All foods for stock sold in Western Australia are required by the Feeding Stuffs Act, 1928-1951, to be registered annually with the Department of Agriculture. For the purposes of the Act, "Foods for Stock" includes stock licks, which in turn embrace all preparations claimed to supply or primarily intended to supply mineral matter to stock.

The registration year for stock foods commences on July 1 each year. When making application for registration manufacturers must submit a guaranteed analysis for each of their products, together with a list of ingredients used in each stock food. Regular inspection and sampling is carried out by officers of the Department to see that stock foods comply with the registered analysis.

Sellers of stock foods are required by the Feeding Stuffs Act to ensure that to each package is clearly and conspicuously attached a label or brand showing the name and place of business of the manufacturer or importer, the registered brand and name of the food or lick and the registered analysis.

A list of stock foods and stock licks which have been registered for the current registration year appears hereunder, together with a list of results of analysis of official samples taken by Departmental inspectors.

Before purchasing any food or lick, buyers are advised to consult the list of registered stock foods and stock lists from which a comparison of foods or licks of similar types can be made and also to ensure that packages are correctly labelled. If any doubts arise, inquiries should be made at the Department of Agriculture, where information on the provisions and requirements of the Feeding Stuffs Act and advice on other aspects of stock feeding can be obtained.



| Stock Food. | Applic. No. | Brand. | By whom registered. | Materials from which made. | Registered Analysis. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Crude Protein. | Crude Fat. | Crude Fibre. | Sodium Chloride (NaCl). | Phosphoric Acid ($P_2O_5$). | Calcium (Ca). | Percentages of other substances claimed to be of †Medicinal or Nutritive Value. |
| | | | | | % (Min.) | % (Max.) | % (Max.) | % (Max.) | % (Max.) | % (Max.) | % |
| **A.—Simple Foods.** | | | | | | | | | | | |
| 1.—*Meat Meals.* | | | | | | | | | | | |
| Meat Meal | 10 | COOGEE | Anchorage Butchers Pty. Ltd. | Waste meat products | 36·0* | 18·0 | 2·0 | 1·0<br>nil * | 12·5<br>9·01 | 12·5<br>8·0* | |
| Do. | 29 | WATSONIA | Watsons Foods Pty. Ltd. | Abattoir offal | 27·0* | 19·7<br>17·7* | 1·5 | .... | 17·3<br>15·3* | 15·5<br>13·5 | |
| Do. | 34 | W.A.M.E. | West Australian Meat Export Works | Meat bone and blood | 50·0* | 13·0 | 2·0 | 2·0<br>*Nil** | 12·0<br>7·0* | 11·0<br>6·0* | |
| Whale Meal | 140 | N.W.W. | Nor-West Whaling Co. Ltd. | Whales | 62·0* | 5·0 | 1·0 | 1·5<br>0·5* | 10·0<br>7·0* | 11·0<br>8·0* | |
| Do. | 213 | CHEYNES BEACH | Cheynes Beach Whaling Co. Ltd. | Whale meat and bones | 53·0* | 6·0<br>4·0* | 5·0 | 2·5<br>1·0* | 16·0<br>14·0* | 15·0<br>13·0* | |
| Meat Meal | 141 | MIDLAND | Midland Junction Abattoirs | Animal slaughtering residues | 50·0* | 15·0<br>12·0* | 2·0 | .... | .... | .... | |
| 2.—*Meat and Bone Meals.* | | | | | | | | | | | |
| Meat and Bone Meal | 12 | T.B. & S. in diamond | Thomas Borthwick & Sons (A/Asia.) Ltd. | Animal offals | 45·0* | 20·0 | 4·0 | .... | 10·0<br>8·0* | 9·0<br>6·0* | |
| Protein Meat and Bone Meal | 35 | CHAMPION | Sims Cooper (Freezing Works) Pty. Ltd. | Meat Works offal | 50·0* | 18·0<br>8·0* | 5·0 | 1·0<br>0·2* | 10·5<br>8·5* | 8·0<br>5·0* | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Bone and Meat Meal.... | 36 | KITCHEN'S .... | J. Kitchen & Sons Pty. Ltd. | Animal fat and bone .... .... | 42·5* | 10·0<br>7·0* | 2·5 | 1·5<br>Nil* | 18·0<br>13·0* | 15·2<br>11·0* | |
| Feeding Meat and Bone Meal | 39 | MERCURY .... | H. C. Sleigh Ltd. .... | Animal meat and bone .... . .. | 45·0* | 13·0<br>11·0* | 1·5 | 0·7<br>0·6* | 20·0<br>17·1* | 13·0<br>11·3* | |
| Bone and Meat Meal .... | 93 | APEX .... | E. J. Fry Pty. Ltd. .... | Meat bone and blood .... .... | 37·0* | 12·0 | 2·0 | 1·0<br>Nil* | 15·0<br>5·0* | 15·0<br>5·0* | |
| Meat and Bone Meal .... | 94 | PENNELLS .... | do. do. .... | Meat and bone .... .... .... | 50·0* | 12·0 | 4·0 | 1·2<br>0·5* | 14·0<br>10·0* | 14·0<br>10·0* | |
| Do. do. .... | 159 | A.J.B. .... | A. J. Bush & Sons Pty. Ltd. | Bones, fats and offals .... .... | 45·0* | 10·0<br>7·0* | 1·5 | .... | 18·0<br>12·0* | .... | |
| 3.—*Liver Meals.* | | | | | | | | | | | |
| 4.—*Whale Solubles.* | | | | | | | | | | | |
| Whale Solubles .... | 139 | N.W.W. .... | Nor-West Whaling Co. Ltd. | Whales .... .... .... .... | 82·0* | 0·4 | 0·1 | 2·5<br>0·5* | 1·5<br>1·0* | 1·5<br>1·0* | |
| 5.—*Fish Meals.* | | | | | | | | | | | |
| Cray Meal .... .... | 9 | ANCHO .... | Anchorage Butchers Pty. Ltd. | Waste crayfish products .. | 36·0* | 12·0<br>9·0* | 10·0 | 3·5<br>2·5* | 7·0<br>4·0* | 14·0<br>11·0* | |
| 6.—*Milk Foods.* | | | | | | | | | | | |
| Dried Buttermilk Powder | 32 | SUNNY WEST | Sunny West Co-operative Dairies Ltd. | Buttermilk .... . . . | 29·0* | 11·0<br>2·0*<br>approx. | 0·5 | 3·0<br>1·0* | 2·5<br>1·5* | 1·5<br>0·5* | 8·6 Ash<br>43·9 Soluble Carbohydrate |
| Skim Milk Powder .... | 37 | PETERS .... | Peters Creameries (W.A.) Pty. Ltd. | Skim milk .... .... .... . | 35·30* | 0·25* | 1·0 | 1·78 | 2·41 | 1·29 | 55·0 Lactose |
| Dried Skim Milk Powder | 45 | SUNNY WEST | Sunny West Co-operative Dairies Ltd. | Liquid milk .... .... . . | 34·0* | 2·0<br>Nil* | 0·5 | 2·0<br>1·0* | 3·0<br>2·0* | 2·0<br>1·0 | 48·0* Lactose |
| 7.—*Wheat and Wheaten By-Products.* | | | | | | | | | | | |
| Wheatmeal .... .... | 85 | "C" MEAL .... | W. Thomas & Co. (W.A.) Ltd. | Wheat .... .... .... . . | 8·0* | .... | 10·0 | .... | .... | .... | |
| Do. .... .... | 102 | MILLERS .... | W. H. Milne & Co. .... | do. .... .... .... .... | 8·0* | .... | 5·0 | .... | .... | .... | |
| 8.—*Oil Seed Meals.* | | | | | | | | | | | |
| Meggitts Linseed Oil Meal | 14 | M.L.M. .... | Elder Smith & Co. Ltd. | Linseed .... .... . . | 35·0* | 6·0<br>3·5* | 10·0 | .... | .... | .... | |
| **B.—Compound Foods.** | | | | | | | | | | | |
| 1.—*Cattle Foods.* | | | | | | | | | | | |
| 10% Protein Cattle Meal | 47 | ENERGY .... | Harvey Produce Supply | Wheat, oats, barley .. . | 10·0* | 2·0<br>1·0* | 10·0 | 1·5<br>1·0* | 1·0<br>0·5* | 1·5<br>1·0* | |
| 16% Protein Sweet Dairy Food | 70 | THOMAS .... | W. Thomas & Co. (W.A.) Ltd. | Bran, pollard, gristed grains, malt combings, bone flour and/or ground phosphate, tech urea, molasses, oyster flour, sodium chloride, manganese sulphate, stabilised iodine, cobalt sulphate | 16·0* | 1·5* | 10·0 | 2·0<br>1·0* | 2·5<br>1·0* | 4·0<br>1·0* | Manganese 60·0 p.p.m.<br>Iodine 1·2 p.p.m.<br>Cobalt 3·0 p.p.m. |
| 16% Protein Sweet Dairy Nuts | 71 | do. .... | do. do. do. | do. do. do. | 16·0* | 1·5* | 8·0 | 2·0<br>1·0* | 2·5<br>0·2* | 4·0<br>1·75* | Cobalt 3·0 p.p.m.<br>Manganese 60·0 p.p.m.<br>Iodine 1·2 p.p.m. |
| 11% Protein Sweet Dairy Food | 72 | do. .... | do. do. do. | Pollard, bran, gristed grains, malt combings, ground rock phosphate, molasses, oyster flour, sodium chloride, manganese sulphate, stabilised iodine, cobalt sulphate | 11·0* | 1·5* | 10·0 | 2·0<br>1·0* | 2·5<br>1·0* | 4·0<br>1·0* | Manganese 60·0 p.p.m.<br>Iodine 1·2 p.p.m.<br>Cobalt 3·0 p.p.m. |
| 32% Dairy Cake Concentrate | 73 | do. .... | do. do. do. | Linseed meal and/or peanut meal, coconut meal, whale meat, tech urea, pollard, bone flour and/or ground phosphate, oyster flour, sodium chloride, manganese sulphate, stabilised iodine and cobalt sulphate | 32·0* | 1·5* | 10·0 | 5·0<br>2·0* | 8·5<br>3·5* | 9·0<br>4·0* | Manganese 600·0 p.p.m.<br>Iodine 10·2 p.p.m.<br>Cobalt 30·0 p.p.m. |

* Minimum. † Reputed.

| Stock Food. | Applic. No. | Brand. | By whom registered. | Materials from which made. | Registered Analysis. Crude Protein. | Crude Fat. | Crude Fibre. | Sodium Chloride ($NaCl$). | Phosphoric Acid ($P_2O_5$). | Calcium (Ca). | Percentages of other substances claimed to be of †Medicinal or Nutritive Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B.—Compound Foods**—*contd.* | | | | | % (Min.) | % (Max.) | % (Max.) | % (Max.) | % (Max.) | % (Max.) | % |
| 1.—*Cattle Foods—contd.* | | | | | | | | | | | |
| Cattle Food .... .... | 106 | EVE-LYN .... | Tropical Traders & Patersons Ltd. | Salt limestone, chalk, molasses, gristed wheat, barley, rye, pollard, animal charcoal, sulphur, sulphate of iron, copper sulphate and medicinal herbs, cobalt chloride, nickel chloride | 5·0* | 2·0<br>1·0* | 5·5 | 13·0<br>12·0* | 4·25<br>3·25* | 9·5<br>8·5* | Sulphur 3·6 |
| Lin Meal .... .... | 117 | WESTERN .... | David Gray & Co. Ltd. | Malt grains, linseed meal, yeast, whale solubles, pollard, wheat cereals, cobalt chloride, copper sulphate, manganese sulphate | 20·0* | 5·0 | 7·0 | 1·5<br>0·5* | 1·5<br>0·5* | 1·0<br>0·15* | |
| 11% Sweetened Dairy Meal | 196 | WESFARMERS | Westralian Farmers Co-op. Ltd. | Bran, pollard, oat meal, meat meal, salt, brewer's grain, bone meal, limestone, molasses | 11·0* | 5·0<br>2·5* | 10·0 | 2·0<br>0·5* | 2·0<br>1·0* | 2·5<br>2·0* | Copper (Cu) Tr.<br>Cobalt (Co) Tr. |
| Sweetened Dairy Meal | 197 | do. | do. do. do. | Bran, pollard, wheat germ, peanut and coconut meals, brewer's grain, salt, rolled wheat, meat meal, bone meal, limestone, bluestone | 16·0* | 5·0<br>2·5* | 10·0 | 3·5<br>2·0* | 3·5<br>2·3* | 2·5<br>2·0* | |
| Dairy Food (High Energy) | 205 | P.P. .... .... | Picton Produce Pty. Ltd. | Oats and barley meals, linseed and bone meals, bran, pollard, calcium, salt, molasses | 12·0* | 4·0<br>3·0* | 12·5 | 1·5<br>0·5* | 1·5<br>0·5* | 1·5<br>0·5* | Copper (Cu) Tr.<br>Cobalt (Co) Tr. |
| Dairy Food (High Protein) | 206 | do. .... .... | do. do. do. | Mill offal, linseed, oat and barley meals, meat and bone meals, urea, molasses, rock phosphate, bran, pollard, salt | 16·0* | 5·0<br>2·0* | 10·0 | 1·5<br>0·5* | 1·5<br>0·5* | 1·5<br>0·5* | Copper (Cu) Tr.<br>Cobalt (Co) Tr. |
| 2.—*Calf Foods.* | | | | | | | | | | | |
| Calf Food .... .... | 5 | HARPER'S "STAR" | Robert Harper & Co. Ltd. | Wheat, oats, rice, barley, linseed, mustard, branning, whiting, salt, peas, and condiments | 12·0* | 2·5* | 10·0 | 2·0<br>1·0* | 2·5<br>1·0* | 1·0<br>0·25* | |
| 20% Protein Vitamised Antibiotic Calf Food | 74 | THOMAS .... | W. Thomas & Co. (W.A.) Ltd. | Linseed meal, coconut meal, pollard, bone flour, and/or ground phosphate rock, oyster flour, sodium chloride, manganese sulphate, stabilised iodine, cobalt sulphate, stabilised vitamins A and $D_3$ procaine penicillin. | 20·0* | 2·5* | 8·0 | 3·0<br>0·5* | 2·5<br>0·2* | 2·5<br>0·5* | Vitamins "A" 6,000,000 I.U./ton<br>Vitamins "$D_3$" 1,800,000 I.U./ton<br>Manganese 60·0 p.p.m.<br>Cobalt 3·0 p.p.m.<br>Iodine 1·2 p.p.m. |
| Calf Food .... .... | 104 | EVE-LYN .... | Tropical Traders & Patersons Ltd. | Gristed wheat, barley, rye, pollard, linseed, salt, sugar, chalk, Turmeric, sodium bicarb, cream of tartar, foenugreek, coriander, copper sulphate and trace bole armenian | 8·5* | 2·0* | 3·86 | 3·5<br>2·5* | 1·25<br>0·25* | 1·0<br>0·2* | Carbohydrates 66·45<br>Sulphur (Max.) 1·75 |
| Do. .... .... | 116 | WESTERN .... | David Gray & Co. Ltd. | Malt grains, milk powder, yeast, whale solubles, pollard, wheat, cereals and trace elements | 16·0* | 6·0* | 7·5 | 1·5<br>0·5* | 1·5<br>0·5* | 1·0<br>0·15* | |
| Do. .... .... | 131 | KAF-O-VITE | Goldsbrough Mort & Co. Ltd. | Wheaten and rice pollard, barley meal, wheat meal, meat meal, coconut meal, peanut meal, sugar, safflower meal, lucerne meal, calcium carbonate, bone charcoal | 16·0* | 7·0<br>6·0* | 8·0 | .... | 2·5* | 4·2* | |
| Calf Meal .... .... | 158 | GROCALF .... | Barrow Linton Pty. Ltd. | Wheat meal, wheat pollard, oat meal, Gro-Calf concentrate | 20·0* | 4·0<br>6·0* | 4·0 | ... | 1·0 | ... | |
| Brewer's Dried Yeast .... | 31 | "B.D." YEAST | Ken McGibbon & Co. .. | Brewery yeast .... .... ... | 45·0* | 1·5 | 1·5 | ... | ... | 13·0<br>11·0* | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Calf Food .... .... | 210 | P.P. .... .... | Picton Produce Pty. Ltd. | Linseed, oat and barley meals, milk powder, molasses, minerals supplement, Vitamins A and $D_3$ | 18·0* | 5·0<br>3·0* | 7·5 | 0·50<br>0·10* | 2·5<br>1·0* | 2·5<br>1·0* | |
| 3.—*Sheep Foods.*<br>11% Protein Vitamised Maintenance Sheep Nuts | 81 | THOMAS | W. Thomas & Co. (W.A.) Ltd. | Oyster flour, sodium chloride, bran, pollard, grain meals, bone flour, and/or ground phosphate, molasses and Vitamins A and $D_3$ | 11·0* | 1·0* | 15·0 | 2·0<br>1·0* | 2·0<br>0·5* | 3·5<br>1·5* | Manganese 60·0 p.p.m.<br>Iodine 1·2 p.p.m.<br>Cobalt 3·0 p.p.m.<br>Vitamin "A" 6,000,000 I.U./ton<br>Vitamin "$D_3$" 1,800,000 I.U./ton. |
| 21% Protein Vitamised Ewe Lamb and Breeders Nuts | 82 | do. | do. do. do. | Peanut meal, linseed meal, bran, Pollard, tech. urea, bone flour, and/or ground Phosphate, molasses, Oyster flour, sodium chloride, Vitamins A and $D_3$ | 21·0* | 2·0* | 11·5 | 4·0<br>2·0* | 3·0<br>1·0* | 4·0<br>2·0* | do. do. |
| Ewe and Lamb Sheep Nuts | 88 | WESTERN .... | Hemphill Gray Oil Mills | Malt grains, yeast, linseed, meat-meal, whale solubles, molasses, wheat, rye, barley | 20·0* | 4·0<br>3·0* | 7·5 | 1·5<br>0·5* | 1·5<br>1·0* | 2·0<br>1·0* | Copper Trace<br>Cobalt Trace |
| Sheep Food .... .... | 107 | EVE-LYN .... | Tropical Traders and Patersons Ltd. | Gristed wheat, barley, rye, pollard, salt, limestone, chalk, sulphur, animal charcoal, molasses, sulphate of iron, copper sulphate, cobalt, nickel chloride, and medicinal herbs | 5·0* | 2·0<br>1·0* | 5·0 | 13·5<br>12·5* | 4·0<br>3·5* | 9·6<br>8·6* | Sulphur 2·75 (max.) |
| 4.—*Poultry Foods.*<br>Laying Mash No. 1 .... | 6 | WRIGHTS .... | Wrights Ltd. ... .. | Bran, pollard, wheat meal, meat meal, whale meal, bone meal, gristed oats, oyster flour, common salt | 16·0* | 6·0<br>3·0* | 6·0 | 1·5<br>0·75* | 3·0<br>1·0* | 3·5<br>1·0* | |
| Vitamin "A" and "$D_3$" Fortified Laying Mash No. 1 | 7 | do. .... | do. .... .... | do. do. do. | 16·0* | 6·0<br>3·0* | 6·0 | 1·5<br>0·75* | 3·0<br>1·0* | 3·5<br>1·0* | |
| Special Laying Mash.... | 20 | MAYCO .... | The Maylands Milling Co. | Bran, pollard, wheat meal, meat meal, bone meal, shellgrit and salt | 17·0* | 4·0*<br>3·5* | 5·0 | 1·0<br>0·75* | 3·0<br>2·5* | 3·5<br>3·0* | |
| 20% Protein Laying Mash | 50 | THOMAS .... | W. Thomas & Co. | Bran, pollard, gristed grains, wheatgerm, whale meal, dried solubles, whale solubles and/or meat meal, oyster flour, bone flour, and/or ground phosphate, sodium chloride | 20·0* | 2·5* | 6·0 | 1·5<br>0·5* | 7·0<br>2·0* | 3·75<br>1·0* | |
| 20% Protein Vitamisul Laying Mash | 51 | do. | do. do. | Bran, pollard, gristed grains, wheatgerm, whale meal, dried solubles, whale solubles and/or meat meal, oyster flour, bone flour and/or ground phosphate, sodium chloride, Vitamins "A" and $D_3$ | 20·0* | 2·5* | 6·0 | 1·5<br>0·5* | 7·0<br>2·0* | 3·75<br>1·0* | Vitamin "A" 12,000,000 I.U./ton<br>Vitamin "$D_3$" 3,600,000 I.U./ton |
| 16% Protein Laying Mash No. 1 (All Mash) | 52 | do. .... | do. do. do. | Bran, pollard, gristed grains, wheatgerm, whale meal, dried solubles, whale solubles and/or meat meal, oyster flour, bone flour and/or ground phosphate, sodium chloride | 16·0* | 2·5* | 6·0 | 2·0<br>0·25* | 3·5<br>1·0* | 3·75<br>1·0* | |
| 16% Protein Vitamised Laying Mash No. 1 (All Mash) | 53 | do. .... | do. do. do. | Bran, pollard, gristed grains, wheatgerm, whale meal, dried solubles, whale solubles and/or meat meal, oyster flour, bone flour and/or ground phosphate, sodium chloride, Vitamins A and $D_3$ | 16·0* | 2·5* | 6·0 | 2·0<br>0·5* | 3·5<br>1·0* | 3·75<br>1·0* | Vitamin "A" 6,000,000 I.U./ton<br>Vitamin "$D_3$" 1,800,000 I.U./ton |
| 13% Protein Vitamised Fattening Mash | 57 | do. .... | do. do. do. | Oyster flour, bone flour and/or ground phosphate, bran, pollard, gristed grains, wheat germ, whale meal, whale solubles and/or meat meal, stabilised Vitamins A and $D_3$ | 13·0* | 2·0* | 6·5 | 1·5<br>0·5* | 3·5<br>1·0* | 3·75<br>1·0* | Vitamin "A" 6,000,000 I.U./ton<br>Vitamin "$D_3$" 1,800,000 I.U./ton |

* Minimum. † Reputed.

| Stock Food. | Applic. No. | Brand. | By whom registered. | Materials from which made. | Registered Analysis. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Crude Protein. | Crude Fat. | Crude Fibre. | Sodium Chloride (NaCl). | Phosphoric Acid ($P_2O_5$). | Calcium (Ca). | Percentages of other substances claimed to be of †Medicinal or Nutritive Value. |
| **B.—Compound Foods**—*contd.* | | | | | % (Min.) | % (Max.) | % (Max.) | % (Max.) | % (Max.) | % (Max.) | % |
| *4.—Poultry Foods—ctd.* | | | | | | | | | | | |
| 20% Protein Laying Pellets | 58 | THOMAS .... | W. Thomas & Co. .... | Oyster flour, bone flour and/or ground phosphate, bran, pollard, gristed grains, wheat germ, whale meal, whale solubles and/or meat meal | 20·0* | 2·5* | 6·0 | 1·5<br>0·5* | 7·0<br>2·0* | 3·75<br>1·0* | |
| 20% Protein Vitamised Laying Pellets | 59 | do. | do. do. do. | Oyster flour, bone flour and/or ground phosphate, bran, pollard, gristed grains, wheat germ, whale meal, whale solubles and/or meat meal, stabilised Vitamins A and $D_3$ | 20·0* | 2·5* | 6·0 | 1·5<br>0·5* | 7·0<br>2·0* | 3·75<br>1·0* | Vitamin "A" 12,000,000 I.U./ton<br>Vitamin "$D_3$" 3,600,000 I.U./ton |
| 16% Protein Laying Pellets No. 1 (All Pellets) | 60 | do. | do. do. do. | Oyster flour, bone flour and/or ground phosphate, bran, pollard, gristed grains, wheat germ, whale meal, whale solubles and/or meat meal | 16·0* | 2·5* | 6·0 | 2·0<br>0·45* | 3·5<br>0·45* | 3·75<br>1·0* | |
| 16% Protein Vitamised Laying Pellets No. 1 (All Pellets) | 61 | do. | do. do. do. | Oyster flour, bone flour, and/or ground phosphate, bran, pollard, gristed grains, wheat germ, whale meal, whale solubles and/or meat meal, stabilised Vitamins A and $D_3$ | 16·0* | 2·5* | 6·0 | 2·0<br>0·5* | 3·5<br>0·75* | 3·75<br>1·0* | Vitamin "A" 6,000,000 I.U./ton<br>Vitamin "$D_3$" 1,800,000 I.U./ton |
| 20% Protein Broiler Granules | 65 | do. | do. do. do. | Bran, pollard, cereal, meals, wheat germ, meat meal and/or whale meal, whale solubles and/or dried solubles, pea meal, bone flour, and/or ground phosphate, Oyster flour, riboflavin. Procaine penicillin, stabilised vitamins A and $D_3$, Nitrofurazone (Nefco) | 20·0* | 2·5* | 6·0 | 0·75<br>0·15* | 3·0<br>1·0* | 2·5<br>1·0* | Vitamin "A" 6,000,000 I.U./ton<br>Vitamin "$D_3$" 1,800,000 I.U./ton |
| 13% Protein Vitamised Fattening Pellets | 66 | do. | do. do. do. | Bran, pollard, gristed grains, wheat germ, whale meal, whale solubles and/or meat meal, oyster flour, bone flour and/or ground phosphate, stabilised vitamins A and $D_3$ | 13·0* | 2·0* | 6·5 | 1·5<br>0·5* | 3·5<br>1·0* | 3·75<br>1·0* | do. do. |
| 18% Breeders Pellets | 67 | do. .... | do. do. do. | Bran, pollard, wheat meal, barley meal, whale meal, meat meal, skim milk powder, dried brewers yeast, bone flour, oyster flour, sodium chloride, manganese sulphate, riboflavin, stabilised vitamins A and $D_3$ | 18·0* | 2·5* | 6·0 | 2·0<br>0·5* | 3·75<br>1·0* | 3·75<br>1·0* | do. do. |
| 40% Vitamised Universal Poultry Concentrate | 68 | do. | do. do. do. | Whale meal and/or meat meal and/or fish meal, bone flour and/or ground rock Phosphate, oyster flour, manganese sulphate, Stabilised vitamins A and $D_3$, riboflavin, trace minerals | 40·0* | 9·0 | 1·5 | 0·4<br>0·2* | 12·5<br>8·5* | 20·5<br>18·5* | Vitamin "A" 40,000,000 I.U./ton<br>Vitamin "D" 4,000,000 I.U./ton<br>Vitamin "$B_2$" 12 micrograms/gram |
| Laying Mash .... .... | 89 | APEX .... | E. J. Fry Pty. Ltd. .... | Wheat meal, bran, pollard, meat meal, bone meal, oyster flour, whale meal | 16·0* | 3·0* | 6·0 | 1·0<br>0·25* | 3·0<br>1·1* | 3·0<br>2·3* | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Laying Mash (A and $D_3$) | 91 | do. | do. do. ... | Wheat meal, bran, pollard, meat meal, bone meal, oyster flour, whale meal, vitamins A and $D_3$ | 16·0* | 3·0* | 6·0 | 1·0<br>0·25* | 3·0<br>1·1* | 3·0<br>2·3* | Vitamin "A" 3,000 I.U./lb.<br>Vitamin "$D_3$" 300 I.U./lb. |
| Laying Mash .... .... | 95 | K.B. .... ... | do. do. ... | Bone meal, oyster flour, whale meal, bran, pollard, wheat meal, meat meal | 18·0* | 4·5<br>3·5* | 7·0 | 2·0<br>0·25* | 4·0<br>1·2* | 5·0<br>1·9* | |
| Laying Mash No. 1 .... | 96 | MILLERS .... | W. H. Milne & Co. .... | Bran, pollard, meat meal, wheat meal, whale and bone meal, oyster flour, gristed oats, salt | 16·0* | 6·0<br>3·0* | 6·0 | 1·5<br>0·75* | 3·0<br>1·0* | 3·5<br>1·0* | |
| 16% Laying Mash Vitamin A and $D_3$ Fortified | 97 | do. | do. do. ... | Bran, pollard, wheat meal, whale-meal, meat meal, bone meal, gristed oats, oyster flour, common salt, vitamin A and $D_3$ | 16·0* | 6·0<br>3·0* | 6·0 | 1·5<br>0·75* | 3·0<br>1·0* | 3·5<br>1·0* | Vitamin "A" 6,000,000 I.U./ton<br>Vitamin "$D_3$" 600,000 I.U./ton |
| 18% Laying Mash Vitamin A and $D_3$ Fortified | 98 | do. | do. do. ... | do. do. do. | 18·0* | 6·0<br>3·0* | 6·0 | 1·5<br>0·75* | 3·0<br>1·0* | 3·5<br>1·0* | do. do. |
| Fattening Mash .... | 101 | do. | do. do. .... | Bran, pollard, gristed oats, meat meal, wheat meal, common salt, limestone | 13·0* | 6·0<br>3·0* | 6·0 | 1·5<br>0·75* | 3·0<br>1·0* | 3·5<br>1·0* | |
| Laying Mash .... .... | 112 | SYMONDS .... | E. Symonds .. ... | Bran, pollard, gristed grains, wheat germ, whale meal, dried solubles, whale solubles and/or meat meal, oyster flour, bone flour and/or ground phosphate, sodium chloride | 16·0* | 2·5* | 6·0 | 2·0<br>0·25* | 3·5<br>1·0 | 3·75<br>1·0* | |
| Laying Pellets .... | 113 | do. | do. do. .... .... | do. do. do. | 16·0* | 2·5* | 6·0 | 2·0<br>0·25* | 3·5<br>1·0* | 3·75<br>1·0* | |
| Laying Mash 16% Protein | 126 | MORLAY .... | R. B. Young Products Pty. Ltd. | Wheat meal, bran, pollard, oyster shell flour, meat meal, whale meal, whale solubles, bone meal, rock phosphate, minerals | 16·0* | 3·0* | 5·5 | 2·0<br>0·25* | 3·0<br>1·0 | 4·0<br>1·5* | |
| Laying Mash (Vitamin Fortified) | 127 | do. | do. do. do. | Wheat meal, bran, pollard, oyster shell flour, meat meal, whale meal, whale solubles, bone meal, rock phosphate, minerals, vitamins A and $D_3$ | 16·0* | 3·0* | 5·5 | 2·0<br>0·25* | 3·0<br>1·0* | 4·0<br>1·5* | Vitamin "A" 3,300 I.U./lb.<br>Vitamin "$D_3$" 330 I.U./lb. |
| H.P. Laying Mash .... | 128 | do. .... | do. do. do. | Bran, pollard, wheat meal, whale meal, whale solubles, oyster flour, Rock phosphate, minerals | 20·0* | 3·0* | 5·5 | 2·0<br>0·25* | 3·0<br>1·0* | 4·0<br>1·5* | |
| H.P. Laying Mash, Vitamin Fortified (A and $D_3$) | 129 | do. .... | do. do. do. | Bran, pollard, wheat meal, whale meal, whale solubles, oyster flour, rock phosphate, minerals, Vitamin A and $D_3$ | 20·0* | 3·0* | 5·5 | 2·0<br>0·25* | 3·0<br>1·0* | 4·0<br>1·5* | Vitamin "A" 3,300 I.U./lb.<br>Vitamin "$D_3$" 330 I.U./lb. |
| Laying Mash .... .... | 144 | PARSONS .... | Parson's Pty. Ltd. .... | As per "Thomas" 16% Laying mash No. 1 | 16·0* | 2·5* | 6·0 | 2·0<br>*Nil** | 3·5<br>*Nil** | 3·75<br>*Nil** | |
| Concentrate for caged layers | 146 | CLARK'S CHECKER-MIX | Barrow Linton Pty. Ltd. | Lucerne meal, meat and bone meal, dried milk products, salt, limestone flour, sterilised bone flour, dicalcic-phosphate, manganese sulphate, vitamins A, $D_3$, $B_2$, $B_{12}$ | 34·0* | 8·0<br>6·0* | 6·0 | 3·5 | 8·0* | 16·5 | |
| Concentrate for Broilers | 147 | do. .... | do. do. do. | Maize products, meat and bone meal, blood and liver meal, dried milk products, salt, limestone flour, sterilised bone flour, dicalcic phos., manganese sulphate vitamin A, $D_3$, $B_2$, $B_{12}$ | 42·0* | 10·0<br>8·0* | 2·0 | 2·5* | 8·0* | 10·0* | |
| Concentrate for Breeders | 148 | do. .... | do. do. do. | do. do. do. | 36·0* | 9·0<br>7·0* | 2·0 | 4·5 | 8·0* | 17·0* | Vitamin "A" 44·0 I.U./gr.<br>Vitamin "$D_3$" 4·4 I.U./gr.<br>Vitamin "$B_2$" 14·0 megms. per gr.<br>Vitamin "$B_{12}$" 0·2 Megms./gr. |

* Minimum. † Reputed.

| Stock Food. | Applic. No. | Brand. | By whom registered. | Materials from which made. | Registered Analysis. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Crude Protein. | Crude Fat. | Crude Fibre. | Sodium Chloride (NaCl). | Phosphoric Acid ($P_2O_5$). | Calcium (Ca). | Percentages of other substances claimed to be of †Medicinal or Nutritive Value. |
| **B.—Compound Foods—** *contd.* | | | | | % (Min.) | % (Max.) | % (Max.) | % (Max.) | % (Max.) | % (Max.) | |
| *4.—Poultry Foods—ctd.* | | | | | | | | | | | |
| Concentrate for Penned Layers | 149 | CLARK'S CHECKER MIX | Barrow Linton Pty. Ltd. | Meat, bone and blood meals, salt, dried milk products, limestone flour, dicalcic phosphate, sterilised bone flour, manganese sulphate, vitamin A, $D_3$, $B_2$, $B_{12}$ | 38·0* | 9·0<br>8·0* | 2·0 | 5·0 | 8·5* | 18·0* | |
| Broiler Mash .... .... | 152 | CHECKER MIX | do. do. do. | Bran, pollard, wheat, oats, barley, broiler concentrate | 17·0* | 3·5 | 6·0 | 0·5* | 2·0* | 1·0* | |
| Penned Layers Mash | 153 | do. .... | do. do. do. | Bran, pollard, wheat, oats, barley, Penned layers concentrate | 15·5* | 4·0 | 7·0 | 0·5* | 2·0* | 2·5* | |
| Breeders Mash .... | 154 | do. .... | do. do. do. | Bran, pollard, wheat, oats, barley, Breeders concentrate | 17·0* | 4·0 | 7·0 | 0·6* | 2·0* | 2·5* | |
| Laying Mash .... .... | 155 | do. .... | do. do. do. | Bran, pollard, wheat meal, barley meal, ground oats, concentrate for penned layers | 18·2* | 4·3 | 4·9 | Trace | 1·0* | Trace | |
| 16% Lay Mash .... | 162 | RICHFOODS | A. Richards & Co. .... | Wheat meal, meat meal, whale meal bran, pollard, oat meal, oyster flour and bone meal | 16·0* | 6·0<br>4·0* | 7·0 | 1·0<br>*Nil** | 3·5<br>2·3* | 2·5<br>2·0* | |
| Vitamised 16% Laymash | 164 | do. .... | do. do. do. | Wheat meal, meat meal, whale meal bran, pollard, oat meal, oyster flour and bone meal, vitamins A and $D_3$ | 16·0* | 6·0<br>4·0* | 7·0 | 1·0<br>*Nil** | 3·5<br>2·3* | 2·5<br>2·0* | Vitamin "A" 2,000 I.U./lb.<br>Vitamin "$D_3$" 500 I.U./lb. |
| Vitamised 20% Laymash | 165 | do. .... | do. do. do. | do. do. do. | 20·0* | 10·0<br>6·0* | 7·0 | 1·0<br>*Nil** | 4·0<br>1·0* | 3·5<br>1·5* | do. do. |
| 18% Protein High Energy Vitamised Laying Pellets | 169 | THOMAS .... | W. Thomas & Co. W.A. Ltd. | Bran, pollard, gristed grains, wheat germ, whale meal, oyster flour, bone flour and/or ground phosphate stabilised vitamins A and $D_3$ | 18·0* | 2·5* | 6·0 | 3·5<br>0·5* | 3·75<br>1·0* | 3·75<br>1·0* | Vitamin "A" 6,000,000 I.U./ton<br>Vitamin "$D_3$" 1,800,000 I.U./ton |
| 16% Protein High Energy Laying Pellets | 170 | do. .... | do. do. do. | Bran, pollard, gristed grains, wheat germ, whale meal, dried solubles, whale solubles and/or meat meal, oyster flour, bone flour and/or ground phosphate | 16·0* | 2·5* | 6·0 | 3·5<br>0·5* | 3·75<br>1·0* | 3·75<br>1·0* | |
| 16% Protein High Energy Vitamised Laying Pellets | 171 | do. .... | do. do. do. | Bran, pollard, gristed grains, wheat germ, whale meal, dried solubles, whale solubles and/or meat meal, oyster flour, bone flour and/or ground phosphate, vitamins A and $D_3$ | 16·0* | 2·5* | 6·0 | 3·5<br>0·5* | 3·75<br>1·0* | 3·75<br>1·0* | Vitamin "A" 6,000,000 I.U./ton<br>Vitamin "$D_3$" 1,800,000 I.U./ton |
| 18% Protein High Energy Vitamised Laying Pellets | 172 | do. .... | do. do. do. | Bran, pollard, gristed grains, wheat germ, whale meal, dried solubles, whale solubles and/or meat meal, oyster flour, bone flour and/or ground phosphate | 18·0* | 2·5* | 6·0 | 3·5<br>0·5* | 3·75<br>1·0* | 3·75<br>1·0* | |
| "P" All Mash .... | 176 | WESFARMERS | Westralian Farmers Co. Ltd. | Bran, pollard, rolled wheat, gristed oats, meat meal or whale solubles, bone meal, oyster flour | 16·0* | 6·0<br>4·0* | 7·0 | 1·0<br>*Nil** | 3·5<br>2·3* | 2·5<br>2·0* | |
| "P" All Mash A and $D_3$ | 177 | do. .... | do. do. do. | Bran, pollard, rolled wheat, gristed oats, meat meal or whale solubles, bone meal, oyster flour, vitamins A and $D_3$ | 16·0* | 6·0<br>4·0* | 7·0 | 1·0<br>*Nil** | 3·5<br>2·3* | 2·5<br>2·0* | Vitamin "A" 3,300 I.U./lb.<br>Vitamin "$D_3$" 450 A.O.A.C. Chick Units/lb. |
| Hi-Protein Mash .... | 178 | do. .... | do. do. do. | Bran, pollard, wheat, meat meal, whale meal, bone meal shelldust | 20·0* | 10·0<br>6·0* | 8·0 | 0·5<br>0·1* | 5·0<br>4·0* | 2·5<br>1·5* | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hi-Protein Mash A and $D_3$ | 179 | do. | do. | do. | do. | Bran, pollard, wheat, meat meal, whale meal, bone meal shelldust vitamins A and $D_3$ | 20·0* | 10·0<br>6·0* | 8·0 | 0·5<br>0·1* | 5·0<br>4·0* | 2·5<br>1·5* | Vitamin "A" 6,640 I.U./lb.<br>Vitamin "$D_3$" 900 A.O.A.C. Chick Units/lb. |
| All Mash Pellets .... | 187 | RED COMB .... | do. | do. | do. | Bran, pollard, rolled wheat, oatmeal, meat meal, bone meal, oyster flour | 16·0* | 6·0<br>4·0* | 7·0 | 1·0<br>*Nil** | 3·5<br>2·3* | 2·5<br>2·0* | |
| All Mash Pellets A and $D_3$ | 188 | do. .... | do. | do. | do. | Bran, pollard, rolled wheat, oat meal, meat meal, bone meal oyster flour, vitamins A and $D_3$ | 16·0* | 6·0<br>4·0* | 7·0 | 1·0<br>*Nil** | 3·5<br>2·3* | 2·5<br>2·0* | Vitamin "A" 3,300 I.U./lb.<br>Vitamin "$D_3$" 450 A.O.A.C. Chick Units/lb. |
| Hi-Protein Pellets .... | 189 | RED-COMB .... | Westralian Farmers Co. Ltd. | | | Bran, pollard, wheat, meat meal, whale meal, bone meal, shell dust | 20·0* | 10·0<br>6·0* | 8·0 | 0·5<br>0·1* | 5·0<br>4·0* | 2·5<br>1·5* | |
| Hi-Protein Pellets A and $D_3$ | 190 | do. .... | do. | do. | do. | Bran, pollard, wheat, meat meal, whale meal, bone meal, shell dust, vitamins A and $D_3$ | 20·0* | 10·0<br>6·0* | 8·0 | 0·5<br>0·1* | 5·0<br>4·0* | 2·5<br>1·5* | Vitamin "A" 6,640 I.U./lb.<br>Vitamin "$D_3$" 900 A.O.A.C. Chick Units/lb. |
| Laying Mash .... .... | 208 | P.P. .... .... | Picton Produce Pty. Ltd. | | | Bran, pollard, wheat and oat meals, meat and bone meals, linseeed, lime, salt and vitamins | 15·0* | 5·0<br>3·0* | 7·0 | 1·0<br>0·5* | 2·5<br>0·5* | 2·5<br>0·5* | |
| 5.—*Chick Foods.* Growing Mash .... | 21 | MAYCO .... | The Maylands Milling Co. | | | Riboflavin, emulsified fish oil, bran, pollard, wheat meal, meat meal, salt, bone meal, shell grit | 15·0* | 4·0<br>3·5* | 5·0 | 1·0<br>0·75* | 3·0<br>2·5* | 3·5<br>3·0 | Manganese Sulphate ·025. |
| Special Chick Starter .... | 22 | do. .... | do. | do. | do. | do. do. do. | 17·0* | 4·0<br>3·5* | 5·0 | 1·0<br>0·75* | 3·0<br>2·5* | 3·5<br>3·0 | do. do. |
| Chick Food .... .... | 38 | H.C. .... .... | Haynes & Clements .. | | | Wheat, peas, maize, grit .. | 9·0* | 3·0<br>1·5* | 4·5 | .. | .. | .. | Calcium Oxide (CaO) 3·0 |
| No. 1 Chick Food .... | 40 | ANCHOR .... | Anchor Products (W.A.) Pty. Ltd. | | | Peas, barley, wheat, maize, linseed, whale meal, bone, grit, fine shell grit | 16·0* | 1·5* | 6·0 | 0·2<br>0·02* | 2·0<br>0·5* | 6·0<br>2·0* | |
| 18% Protein Antibiotic Vitamised Chick Starter | 54 | THOMAS .... | W. Thomas & Co. (W.A.) Ltd. | | | Bran, pollard, gristed grains, wheat germ, meat meal and/or whale meal, whale solubles, pea meal, bone flour and/or ground phosphate, oyster flour, riboflavin, procaine penicillin, stabilised vitamins A and $D_3$ | 18·0* | 2·5* | 6·0 | 1·5<br>0·25* | 3·0<br>1·0* | 2·5<br>1·0* | Vitamin "A" 6,000,000 I.U./ton<br>Vitamin "$D_3$" 1,800,000 I.U./ton |
| 18% Special C.P. Protein Antibiotic Vitamised Chick Starter | 55 | do. .... | do. | do. | do. | Bran, pollard, gristed grains, wheat germ, meat meal and/or whale meal, whale solubles, pea meal, bone flour and/or ground phosphate, oyster flour, riboflavin, procaine penicillin, stabilised vitamins A and $D_3$, (Nefco) | 18·0* | 2·5* | 6·0 | 1·5<br>0·25* | 3·0<br>1·0* | 2·5<br>1·0† | do. do. |
| 15% Protein Vitamised Chick Grower | 56 | do. .... | do. | do. | do. | Bran, pollard, gristed grains, wheat germ, meat meal and/or whale meal, whale solubles and/or dried solubles, bone flour and/or ground phosphate, oyster flour, sodium chloride, riboflavin, stabilised vitamins A and $D_3$ | 15·0* | 2·5* | 6·0 | 1·25<br>0·5* | 3·5<br>1·0† | 3·75<br>0·5* | do. do. |
| 18% Antibiotic Vitamised Chick Granules | 62 | do. .... | do. | do. | do. | Bran, pollard, gristed grains, wheat germ, meat meal and/or whale meal, whale solubles and/or dried solubles, bone flour and/or ground phosphate, oyster flour, sodium chloride, riboflavin, stabilised vitamins A and $D_3$, procaine penicillin | 18·0* | 2·5* | 6·0 | 0·75<br>0·15* | 3·0<br>1·0* | 2·5<br>1·0* | do. do. |

* Minimum. † Reputed.

## STOCK FOODS—continued.

| Stock Food. | Applic. No. | Brand. | By whom registered. | Materials from which made. | Registered Analysis. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Crude Protein. | Crude Fat. | Crude Fibre. | Sodium Chloride (NaCl). | Phosphoric Acid ($P_2O_5$). | Calcium (Ca). | Percentages of other substances claimed to be of †Medicinal or Nutritive Value. |
| **B.—Compound Foods**—*contd.* | | | | | % (Min.) | % (Max.) | % Max.) | % (Max.) | % (Max.) | % (Max.) | % |
| *5.—Chick Feeds—contd.* | | | | | | | | | | | |
| 18% Special C.P. Antibiotic Vitamised Chick Granules | 63 | THOMAS | W. Thomas & Co. (W.A.) Ltd. | Bran, pollard, gristed grains, wheat germ, meat meal and/or whale meal, whale solubles and/or dried solubles, bone flour and/or ground phosphate, oyster flour, sodium chloride, riboflavin, stabilised vitamins A and $D_3$, (Nefco), procaine penicillin | 18·0* | 2·5* | 6·0 | 0·75<br>0·15 | 3·0<br>1·0* | 2·5<br>1·0* | do. do. |
| 15% Protein Vitamised Growers Pellets | 64 | do. | do. do. do. | Bran, pollard, gristed grains, wheat germ, meat meal and/or whale meal, whale solubles and/or dried solubles, bone flour and/or ground phosphate, oyster flour, sodium chloride, riboflavin, stabilised vitamins A and $D_3$, procaine penicillin | 15·0* | 2·5* | 6·0 | 1·25<br>0·5* | 3·5<br>1·0* | 3·75<br>0·5* | do. do. |
| Chicken Grain | 69 | do. | do. do. do. | Wheat, maize, peas, shell grit | 9·0* | 1·5* | 4·5 | .... | .... | .... | |
| Growers Mash (A and $D_3$) | 90 | APEX | E. J. Fry Pty. Ltd. | Bran, pollard, wheat meal, meat meal, butter milk, bone meal, vitamins A and $D_3$ | 15·0* | 3·0* | 6·0 | 1·0<br>0·25* | 2·0<br>1·1* | 3·0<br>1·5* | Vitamin "A" 3,000 I.U./lb.<br>Vitamin "$D_3$" 300 I.U./lb.<br>(*Minimum) |
| Chick Starter (A and $D_3$) | 92 | do. | do. do. | Bran, pollard, wheat meal, meat meal, bone meal, butter milk, vitamins A and $D_3$ | 17·0* | 3·0* | 6·0 | 1·0<br>0·25* | 2·0<br>1·1* | 3·0<br>1·5* | Vitamin "A" 3,000 I.U./lb.<br>Vitamin "$D_3$" 300 I.U./lb. |
| Chick Starter | 99 | MILLERS | W. H. Milne & Co. | Bran, pollard, wheat meal, meat meal, ribon, bone meal, gristed oats, salt | 16·0* | 6·0<br>3·0* | 6·0 | 1·5<br>0·75* | 2·0<br>1·0* | 2·5<br>1·0* | Vitamin "A" 6,000,000 I.U./ton<br>Vitamin "$D_3$" 600,000 I.U./ton |
| Chick Builder | 100 | do. | do. do. | Bran, pollard, wheat meal, meat meal, bone meal, gristed oats, salt | 15·0* | 6·0<br>3·0* | 6·0 | 1·5<br>0·75* | 3·0<br>1·0* | 3·5<br>1·0* | do. do. |
| Growers Mash | 114 | SYMONDS | E. Symonds | Bran, pollard, gristed grains, wheat germ, meat meal and/or whale meal, whale solubles and/or dried solubles, bone flour and/or ground phosphate, oyster flour, sodium chloride, riboflavin, stabilised vitamins A and $D_3$ | 15·0* | 2·5* | 6·0 | 1·25<br>0·5* | 3·5<br>1·0* | 3·75<br>0·5* | Vitamin "A" 6,000,000 I.U./ton<br>Vitamin "$D_3$" 1,800,000 I.U./ton |
| Chick Starter | 115 | do. | do. | Bran, pollard, gristed grains, wheat germs, meat meal and/or whale meal, whale solubles, pea meal, bone flour and/or ground phosphate, oyster flour, riboflavin, procaine penicillin, stabilised vitamins A and $D_3$ | 18·0* | 2·5* | 6·0 | 1·5<br>0·25* | 3·0<br>1·0* | 2·5<br>1·0* | do. do. |
| Growing Mash (Vitamin Fortified) | 123 | MORLAY | R. B. Young Products Pty. Ltd. | Wheat meal, bran, pollard, meat meal, whale meal, bone meal, oyster flour, dried yeast ribon, minerals, apac | 14·0* | 3·0* | 5·5 | 2·0<br>0·25* | 3·0<br>1·0* | 4·0<br>1·5* | Vitamin "A" 3,300 I.U./lb.<br>Vitamin "$D_3$" 330 I.U./lb. |
| Chick Starter | 124 | do. | do. do. do. | Wheat meal, bran, dried yeast, whale meal, bone meal, shell grit, antibiotic concentrate, nefco concentrate, apac, manganese, minerals, butter milk | 18·0* | 3·0* | 5·5 | 2·0<br>0·25* | 3·5<br>1·0* | 4·0<br>1·5* | do. do. |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chick All Mash (Vitamin Fortified) | 125 | do. .... | do. do. do. | Wheat meal, meat meal, bran, whale meal, bone meal, oyster flour, dried yeast, apac, Nefco concentrate, manganese sulphate, minerals | 15·0* | 3·0* | 6·0 | 2·0<br>0·25* | 3·0<br>1·0* | 4·0<br>1·5* | do. | do. |
| Special Chick Feed .... | 145 | PARSONS .... | Parsons Pty. Ltd. .... | Wheat, green peas, maize, sorghum seed, shell grit | 8·0* | 1·5<br>0·5* | 4·5 | 0·5<br>*Nil** | 1·0<br>0·5* | 4·0<br>3·0* | | |
| Concentrate for Growers | 150 | CLARK'S CHECKER-MIX | Barrow Linton Pty. Ltd. | Maize products, salt, limestone flour, meat and bone meal, blood meal, dried milk products, sterilised bone flour, dicalcic phosphate, manganese sulphate, vitamins A, $D_3$, $B_2$, $B_{12}$ | 38·0* | 9·0<br>8·0* | 2·0 | 4·0 | 8·5* | 13·0* | | |
| Concentrate for Chicks | 151 | do. .... | do. do. do. | do. do. do. | 42·0* | 9·0<br>8·0* | 2·0 | 2·5 | 7·5* | 9·5* | Procaine Penicillin Sulpha-Quinoxaline Sodium | |
| Growers Mash Growell | 156 | CHECKER-MIX | Barrow Linton Pty. Ltd. | Bran Pollard, Wheatmeal, Barley meal, Ground Oats, "Checker Mix" Concentrate for Growers | 17·4* | 4·5 | 4·6 | Trace | 1·0* | Trace | | |
| Chick Starter Vitalizer | 157 | do. | do. do. do. | Bran, Pollard, Wheat meal, Barley meal, Ground Oats, "Checker Mix" Concentrate for Chicks | 20·0* | 4·3 | 4·4 | Trace | 1·0* | Trace | | |
| Vitamised 16% Chick Starter | 163 | RICHFOODS.... | A. Richards & Co. .... | Bran, Pollard, Wheat meal, Meat meal, Buttermilk, Yeast†, Oat meal, Bone meal, Micratized Vitamins A and $D_3$ | 16·0* | 5·0<br>3·0* | 7·0<br>.... | 1·0<br>Nil* | 3·0<br>1·0* | 3·0<br>0·8* | Vitamin "A" 2,000 I.U. per lb.<br>Vitamin "$D_3$" 500 I.U. per lb. | |
| 15% Vitamised Growers Mash | 166 | do. | do. do. .... .... | Wheat meal, meat meal, whale meal, bran, pollard, oat meal, bone meal, Vitamins A and $D_3$ | 15·0* | 5·0<br>3·0* | 7·0<br>.... | 1·0<br>*Nil** | 3·0<br>1·0* | 3·0<br>0·8* | do. | do. |
| P Chick Mash A, A.B., A and $D_3$ | 173 | WES-FARMERS | Westralian Farmers Co. Ltd. | Bran, pollard, cracked wheat, oat meal, meat meal, buttermilk, bone meal, antibiotics, stabilised Vitamins A and $D_3$ | 16·0* | 5·0<br>3·0* | 7·0<br>.... | 1·0<br>*Nil** | 2·3<br>1·2* | 1·3<br>0·8* | Vitamin "A" 2,000 I.U. per lb.<br>Vitamin "$D_3$" 180 A.O.A.C. Chick Units per lb. | |
| P Chick Mash B, A and $D_3$ | 174 | WES-FARMERS | do. do. do. | Bran, pollard, cracked wheat, oat meal, meat meal, buttermilk, bone meal, stabilised Vitamins A and $D_3$ | 15·0* | 5·0<br>3·0* | 7·0 | 1·0<br>*Nil** | 2·3<br>1·2* | 1·3<br>0·8* | do. | do. |
| P Growers Mash A and $D_3$ | 175 | do. | do. do. do. | do. do. do. | 14·0* | 5·0<br>3·0* | 7·0<br>.... | 1·0<br>*Nil** | 2·3<br>1·2* | 1·5<br>1·0* | do. | do. |
| Cockerel Mash "A", AB, A and $D_3$ | 180 | do. | do. do. do. | Gristed wheat, bran, buttermilk, brewers yeast, meat meal, whalemeal, bone meal, manganese sulphate, antibiotics, stabilised A and $D_3$ | 15·0* | 5·0<br>3·0* | 7·0<br>.... | 1·0<br>*Nil** | 2·0<br>1·0* | 2·0<br>*·0* | Vitamin "A" 2,000 I.U. per lb.<br>Vitamin "$D_3$" 400 I.U. per lb. | |
| Cockerel Mash "B" A and $D_3$ | 181 | do. | do. do. do. | Gristed wheat, bran, meat meal, whale meal, bone meal, manganese sulphate | 18·0* | 5·0<br>3·0* | 7·0<br>.... | 1·0<br>*Nil** | 2·0<br>1·0* | 2·0<br>1·0* | do. | do. |
| Chick Pellets "A", A.B., A and $D_3$ | 184 | RED COMB .... | do. do. do. | Bran, pollard, cracked wheat, oat meal, meat meal, buttermilk, bone meal, stabilised Vitamins A and $D_3$, antibiotics | 16·0* | 5·0<br>3·0* | 7·0<br>.... | 1·0<br>*Nil** | 2·3<br>1·2* | 1·3<br>0·8* | Vitamin "A" 2,000 I.U. per lb.<br>Vitamin "$D_3$" 180 A.O.A.C. Chick Units per lb. | |
| Chick Pellets "B", A and $D_3$ | 185 | do. .... | do. do. do. | Bran, pollard, cracked wheat, oatmeal, meat meal, buttermilk, bone meal, stabilised Vitamins A and $D_3$ | 15·0* | 5·0<br>3·0* | 7·0<br>.... | 1·0<br>*Nil** | 2·3<br>1·2* | 1·3<br>0·8* | do. | do. |
| Growers Pellets A and $D_3$ | 186 | do. .... | do. do. do. | Bran, pollard, rolled wheat, oat meal, meat meal, bone meal, stabilised Vitamins A and $D_3$ | 14·0* | 5·0<br>3·0* | 7·0<br>.... | 1·0<br>*Nil** | 2·3<br>1·2* | 1·5<br>1·0* | do. | do. |
| Cockerel Pellets "A" A.B., A and $D_3$ | 191 | WESFARMERS | do. do. do. | Gristed wheat, bran, buttermilk, brewers yeast, meat meal, bone meal, manganese sulphate, Vitamins A and $D_3$, antibiotics | 18·0* | 5·0<br>3·0* | 7·0<br>.... | 1·0<br>*Nil** | 2·0<br>1·0* | 2·0<br>1·0* | Vitamin "A" 2,000 I.U. per lb.<br>Vitamin "$D_3$" 400 I.U. per lb. | |

* Minimum. † Reputed.

| Stock Food. | Applic. No. | Brand. | By whom registered. | Materials from which made. | Registered Analysis. Crude Protein. | Crude Fat. | Crude Fibre. | Sodium Chloride (NaCl). | Phosphoric Acid ($P_2O_5$). | Calcium (Ca). | Percentages of other substances claimed to be of †Medicinal or Nutritive Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B.—Compound Foods—** *contd.* | | | | | % (Min.) | % (Max.) | % (Max.) | % (Max.) | % (Max.) | % (Max.) | % |
| 5.—*Chick Foods—contd.* | | | | | | | | | | | |
| Cockerel Pellets "B" A and $D_3$ | 192 | WESFARMERS | Westralian Farmers Co. Ltd. | Gristed wheat, bran buttermilk, brewers yeast, meat meal, whale-meal, bone meal, manganese sulphate, Vitamins A and $D_3$ | 18·0* | 5·0<br>3·0* | 7·0<br>.... | 1·0<br>*Nil** | 2·0<br>1·0* | 2·0<br>1·0* | Vitamin "A" 2,000 I.U. per lb.<br>Vitamin "$D_3$" 400 I.U. per lb. |
| Chick Starter .. .. | 209 | P.P. .. .... | Picton Produce Pty. Ltd. | Bran, pollard, wheat and oat meals, meat and bone meals, buttermilk, Vitamins A and $D_3$ | 16·0* | 4·0<br>2·5* | 5·0<br>.. | 1·0<br>0·5* | 2·5<br>1·5* | 2·5<br>1·5* | Vitamin "A" 10,000 I.U. per 100 lb.<br>Vitamin "$D_3$" 1,000 I.U. per 100 lb. |
| 6.—*Turkey Foods.* | | | | | | | | | | | |
| Turkey Starter Mash A and $D_3$ | 182 | WESFARMERS | Westralian Farmers Co. Ltd. | Bran, pollard, gristed oats and wheat, dried yeast, buttermilk, meat and bone meals, stabilised Vitamins A and $D_3$ | 24·0* | 5·0<br>3·0* | 7·0<br>.... | 1·0<br>*Nil** | 2·0<br>1·0* | 2·0<br>1·0* | Vitamin "A" 4,000 I.U. per lb.<br>Vitamin "$D_3$" 600 I.U. per lb. |
| 12% Protein Turkey Growers Mash A and $D_3$ | 183 | do. | do. do. do. | do. do. do. | 20·0* | 5·0<br>3·0* | 7·0 | 1·0<br>*Nil** | 2·0<br>1·0* | 2·0<br>1·0* | do. do. |
| Turkey Starter Pellets A and $D_3$ | 193 | do. | do. do. do. | do. do. do. | 24·0* | 5·0<br>3·0* | 7·0<br>.... | 1·0<br>*Nil** | 2·0<br>1·0* | 2·0<br>1·0* | do. do. |
| Turkey Growers Pellets A and $D_3$ | 194 | do. | do. do. do. | do. do. do. | 20·0* | 5·0<br>3·0* | 7·0<br>.... | 1·0<br>*Nil** | 2·0<br>1·0* | 2·0<br>1·0* | do. do. |
| 7.—*Pig Foods.* | | | | | | | | | | | |
| 18% Protein Antibiotic Vitamised Pig Starter | 75 | THOMAS .... | W. Thomas & Co. (W.A.) Ltd. | Pollard, wheatgerm, gristed grains, meat meal and/or whale meal, dried whale solubles, whale solubles, boneflour and/or ground phosphate, oyster flour, salt, riboflavin, procaine penicillin, stabilised Vitamins A and $D_3$, manganese sulphate, stabilised iodine, cobalt sulphate | 18·0* | 2·5*<br>.... | 6·5<br>.... | 2·0<br>1·0* | 3·75<br>1·0* | 4·0<br>1·0 | Vitamin "A" 6,000,000 I.U. per ton.<br>Vitamin "$D_3$" 1,800,000 I.U. per ton.<br>Manganese 60·0 p.p.m.<br>Cobalt 3·0 p.p.m.<br>Iodine 1·2 p.p.m. |
| 18% Protein Antibiotic Vitamised Pig Starter Pellets | 76 | do. .... | do. do. do. | do. do. do. | 18·0* | 2·5*<br>.... | 6·5<br>.. | 2·0<br>1·0* | 3·75<br>1·0* | 4·0<br>1·0* | do. do. * |
| 16% Protein Antibiotic Vitamised Pig Grower | 77 | do. .... | do. do. do. | Pollard, gristed grains, meat meal, salt, whale meal, dried solubles, whale solubles, boneflour and/or ground phosphate, oyster procaine, penicillin, stabilised Vitamins A and $D_3$, manganese sulphate, stabilised iodine, cobalt sulphate | 16·0* | 2·5* | 6·5 | 2·0<br>1·0* | 3·5<br>1·0* | 4·5<br>1·0* | Vitamin "A" 6,000,000 I.U. per ton.<br>Vitamin "$D_3$" 1,800,000 I.U. per ton.<br>Manganese 60·0 p.p.m.<br>Cobalt 3·0 p.p.m.<br>Iodine 2·2 p.p.m. |
| 16% Protein Antibiotic Vitamised Pig Grower Cubes | 78 | do. .... | do. do. do. | do. do. do. | 16·0* | 2·5* | 6·5 | 2·0<br>1·0* | 3·5<br>1·0* | 4·5<br>1·0* | do. do. |
| 14% Protein Pig Fattening Mash | 79 | do. .... | do. do. do. | Pollard, gristed grain, dried solubles, meat meal and/or whale solubles, boneflour and/or ground phosphate, oyster flour, salt, manganese sulphate, stabilised iodine, cobalt sulphate | 14·0* | 2·5* | 6·0 | 2·0<br>1·0* | 3·75<br>1·0* | 4·0<br>1·0* | Manganese 60·0 p.p.m.<br>Cobalt 3·0 p.p.m.<br>Iodine 1·2 p.p.m. |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14% Protein Pig Fattening Cubes | 80 | do. .... | do. do. do. | Pollard, gristed grain, dried solubles, meat meal and/or whale solubles, bone flour and/or ground phosphate, oyster fleur, salt, manganese sulphate, stabilised iodine, cobalt sulphate | 14·0* | 2·5* | 6·5 | 2·0<br>1·0* | 3·75<br>1·0* | 4·0<br>1·0* | Manganese 60·0 p.p.m.<br>Cobalt 3·0 p.p.m.<br>Iodine 1·2 p.p.m. |
| Pig Food .... .... | 105 | EVE-LYN .... | Tropical Traders & Patersons Ltd. | Gristed wheat, barley, rye, pollard, salt, limestone, chalk, sulphate, animal charcoal, sulphate of iron, limenite, copper sulphate (trace), corlander, arecearute, foenugreek | 5·0* | 1·0* | 5·0 | 9·6<br>8·6* | 3·75<br>3·25* | 9·5<br>8·5* | |
| Pig Mash (Fortified A and $D_3$) | 120 | MORLAY .. | R. B. Young Products Pty. Ltd. | Wheat, pollard, oyster flour, rock phosphate, cereal meals, meat meal, whale meal or solubles, limestone, minerals apac | 14·0* | 3·0* | 6·0 | 2·0<br>0·25* | 3·0<br>1·0* | 4·0<br>1·5* | Vitamin "A" 3,300 I.U. lb.<br>Vitamin "$D_3$" 330 I.U. lb. |
| Pig Mash (Standard) .... | 121 | do. .... | do. do. do. | Wheat, pollard, oyster flour, rock phosphate, cereal meals, meat meal, whale meal or solubles, limestone, minerals | 14·0* | 3·0* | 6·0 | 2·0<br>0·25* | 3·0<br>1·0* | 4·0<br>1·5* | |
| Pig Mash .... .... | 198 | WESFARMERS | Westralian Farmers Co. Ltd. | Bran, pollard, rolled wheat, meat meal, bone meal, limestone, copper | 16·0* | 7·0<br>5·0* | 8·0 | 2·0<br>1·0* | 3·5<br>2·3* | 2·5<br>2·0* | Copper (Cu) 0·1 |
| 8.—*Horse Foods.*<br>12% Protein Sweet Horse Food | 83 | THOMAS .... | W. Thomas & Co. (W.A.) Ltd. | Mill offal, grain meals, molasses, malt combings, bone flour and/or ground phosphate, oyster flour, salt, manganese, sulphate, stabilised iodine, cobalt sulphate | 12·0* | 1·5* | 10·0 | 2·0<br>1·0* | 2·5<br>1·0* | 4·0<br>1·0* | Manganese 60·0 p.p.m.<br>Iodine 1·2 p.p.m.<br>Cobalt 3·0 p.p.m. |
| Horse Food .... .... | 103 | EVE-LYN .... | Tropical Traders & Patersons Ltd. | Pollard, barley, wheat, gristed wheat, whole linseed, salty, chalk, magnesium sulphate, sulphur, sulphate iron, copper sulphate, sodium bicarbonate, medicinal herbs | 8·5* | 3·0<br>2·0* | 7·0 | 5·0<br>4·5* | 1·0<br>0·5* | 1·75<br>0·75* | Sulphur 1·25 |
| 9.—*Dog Foods.*<br>No. 1 Dog Biscuits .... | 23 | SNAPS .... | Snaps Dog Foods .. | Wheat, bone, meat, vegetables | 15·0* | 5·0<br>4·0* | 2·0 | 0·7<br>0·4* | 4·5<br>3·0* | 4·5<br>3·5 | Carbohydrate 62·00 |
| Plain Shapes .... .... | 24 | do. .. | do. do. .... | do. do. do. | 15·0* | 5·0<br>4·0* | 2·0 | 0·7<br>0·4* | 4·0<br>3·0* | 4·0<br>3·0* | do. do. |
| Charcoal Shapes .... | 25 | do. ... | do. do. .... | do. do. do. | 14·0* | 5·0<br>3·0* | 6·0 | 0·7<br>0·4* | 3·0<br>2·0* | 3·0<br>2·0* | do. do. |
| Puppy Meal .... .... | 26 | do. .... | do. do. .... | do. do. do. | 15·0* | 6·0<br>4·0* | 2·0 | 0·6<br>0·3* | 4·0<br>3·0* | 4·5<br>3·5* | do. do. |
| Dog and Cat Food .... | 46 | TUCKER BOX | Tucker Box Dog and Cat Food Co. | Meat, and meat by-products, cereals, vegetables, salt | 10·0* | 5·0<br>2·5* | 0·5 | .... | 1·0 | | |
| 20% Protein Kanine Kibbles | 84 | THOMAS .... | W. Thomas & Co. (W.A.) Ltd. | Predigested cereal meals, wheat germ, grain meals, meat meal, milk powder, molasses, oyster flour, bone meal, salt, potassium iodide, micratised vitamins A and $D_3$ | 20·0* | 1·0* | 2·5 | 1·5<br>0·5* | 2·5<br>0·5* | 2·5<br>0·5* | Vitamin "A" 6,000,000 I.U./ton.<br>Vitamin "$D_3$" 1,800,000 I.U./ton. |
| Dog Biscuits .... .... | 142 | FARRELLS .... | E. M. Farrell & Sons .... | Wheat meal, salt, meat meal, bone meal | 10·0* | 2·0<br>1·0* | 2·5 | 1·0 | .... | .... | |
| Kibbled Dog Meal .... | 143 | do. . . | do. do. .... | do. do. do. | 10·0* | 2·0<br>1·0* | 2·5 | 1·0 | . . | | |
| Dog Food .... .... | 167 | PETS . . .... | Processed Meats Pty. Ltd. | Meat, rabbit, wheat, vegetables | 10·0* | 7·0<br>4·0* | 1·0 | 0·4 | . | | |
| Dog and Cat Food .... | 168 | do. .... | do. do. do. | Meat, rabbit, wheat and fish .... | 10·0* | 7·0<br>4·0* | 1·0 | 0·4 | | | |
| Dog Meal A, B and $D_3$ | 201 | WESFARMERS | Westralian Farmers Co. Ltd. | Bran, pollard, meat meal, dried yeast, buttermilk, bone meal, salt, antibiotics, vitamins A and $D_3$ | 20·0* | 8·0<br>4·0* | 5·0 | 2·0<br>1·0* | 2·5<br>1·0* | 3·0<br>1·0* | Vitamin "A" 4,000 I.U./lb.<br>Vitamin "$D_3$" 450 A.O.A.C. Chick Units/lb. |
| Dog Pellets A.B. A and and $D_3$ | 202 | do. | do. do. do. | do. do. do. | 20·0* | 8·0<br>4·0* | 5·0 | 2·0<br>1·0* | 2·5<br>1·0* | 3·0<br>1·0* | do. do. do. |

* Minimum. † Reputed

| Stock Food. | Applic. No. | Brand. | By whom registered. | Materials from which made. | Registered Analysis. Crude Protein. | Crude Fat. | Crude Fibre. | Sodium Chloride (NaCl). | Phosphoric Acid ($P_2O_5$). | Calcium (Ca). | Percentages of other substances claimed to be of †Medicinal or Nutritive Value. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | % (Min.) | % (Max.) | % (Max.) | % (Max.) | % (Max.) | % M(ax.) | % |
| **C.—Stocklicks.** | | | | | | | | | | | |
| *1.—Bone Meals.* | | | | | | | | | | | |
| Whale Bonemeal .... | 8 | WRIGHTS .... | Wrights, Ltd. .... .... | Whale bone .... .... .... | 8·5* | .... | .... | 1·0 | 27·0* | 28·0* | |
| Bone Meal .. | 11 | ANCHO .. | Anchorage Butchers Pty. Ltd. | Waste meat products . | 23·63* | 2·44* | Trace | Trace | 26·76* | . . | Lime (CaO) 26·95* |
| Sterilised Bone Flour ... | 18 | TRICALOS .... | Davis Gelatine (Aust.) Pty. Ltd. | Bones .... .... .... .... | 5·0* | .... | .... | .... | 30·0* | .... | Lime (CaO) 40·0* |
| Sterilised Bone Grit .... | 19 | do. .... | do. do. do. | do. .... .... .... .... | 5·0* | .... | .... | .... | 30·0* | .... | Lime (CaO) 40·0* |
| Bone Meal .... .... | 30 | WATSONIA .... | Watsons Foods Pty. Ltd. | Abattoir offal and bones . | 14·0* | .... | .... | . | 26·5* | . . | Lime (CaO) 36·0* |
| Do. .... .... | 33 | WAME .... | W.A. Meat Export Works | Bones .... .... .... .... | 18·75* | .... | .... | 0·25 | 26·0* | .... | Lime (CaO) 27·0* |
| Sterilised Bone Flour .. | 86 | THOMAS .... | W. Thomas & Co. (W.A.) Ltd. | Whale bones . . | . . . | . | . | 1·0 | 24·0* | . . | Lime (CaO) 32·0* |
| Sterilised Bone Meal . | 207 | P.P. .... .... | Picton Produce Pty. Ltd. | Sterilised bones .. | 18·75 | .... | .... | 0·25 | 24·0* | . . . | Lime (CaO) 27·0* |
| *2.—Oyster Flours.* | | | | | | | | | | | |
| Oyster Flour .... .... | 161 | DEANS .... | J. Deane & Son . . | Oyster shell .... . | . . . | . . | .... | 0·5 | Trace | .. | Lime (CaO) 42·0* |
| Do. .... .... | 87 | THOMAS .... | W. Thomas & Co. .... | do. .... .... .... | .... | .... | .... | 1·0 | .... | .... | Lime (CaO) 42·0* |

| Stock Food. | Applic. No. | Brand. | By whom Registered. | Materials from which Made. | Registered Analysis. Sodium Chloride (NaCl). | Phosphoric Acid ($P_2O_5$). | Lime (CaO). | Magnesia (MgO). | Iron (Fe). | Sulphur (S). | Iodine (I). | Copper (Cu). | Cobalt (Co). | Manganese (Mn). | Potassium (K). | Zinc (Zu). | Other. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | % (Max.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | |
| *3.—Mixed Stock Licks.* | | | | | | | | | | | | | | | | | |
| Black Band . | 1 | MIN-A-VIT | Hamilcar Holdings Pty. Ltd. | Cobalt sulphate, copper sulphate, sterilized bone flour, calcium carbonate, manganese sulphate, iron Oxide, salt potassium iodide, mineral stable vitamin $D_3$ | 15·0 | 27·0* | 40·0* | .... | 0·077* | .... | 0·030* | 0·0025* | 0·0020* | 0·42* | . . | .... | Ribon 130 Mg lb. Vit. "$D_3$" 6,000 I.U./oz. |
| Orange Band . | 2 | do. | do. do. | Sterilized bone dust, talc, whiting, salt, molasses, copper sulphate, zinc sulphate, manganese sulphate cobalt sulphate, potassium iodide, vitamin concentrate $D_3$ | 21·0 | 18·0* | 22·0* | 2·0* | . . | .... | 0·043* | 0·25* | 0·009* | 0·032* | .... | 0·022* | |
| Red Band . | 3 | do. | do. do. | do. do. do. | 16·0 | 2·0* | 6·0* | 18·0* | 0·625* | .... | 0·043* | 0·025* | 0·009* | 0·032* | . . | 0·022* | Protein 12·0* |
| Black Band Plus Pack | 4 | do. | do. do. | Sterilized bone flour, calcium carbonate, salt, manganese sulphate, iron oxide, potassium iodide, cobalt sulphate, copper sulphate, mineral stable vitamins A and $D_3$ | 15·0 | 27·0* | 40·0* | | 0·077* | . | 0·03* | 0·0025* | 0·0020* | 0·42* | . . | .... | Vit. "A" 675 I.U./gm. Vit. "$D_3$" 6.000 I.U. oz. Ribon 130 Mg. lb. |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rock Salt .... | 13 | ELDER'S ... | Elder Smith & Co. Ltd. | Sodium chloride Marl . | 95·0 | | .. | | .. | .. | ... | .... | ... | ... | ... | .. | | |
| Iodised Mineral Lick | 15 | DAY SON & HEWITT LTD. | Board Ltd. | Limestone flour, sterilised bone flour, sodium chloride iron sulphate, sulphur, Ferric Oxide, potassium iodide | 83·7 | 1·72* | 5·5* | | 0·87* | 0·49* | 0·03* | | | | 0·01 | | | |
| Poultry Spice | 16 | do. | do. do. | Wheat offals, spices and mineral salts | 1·9 1·7* | 1·0 Nil* | Calcium (Ca) 12·0 16·0 | | 2·1 | 1·2 | 38 ppm | 128 ppm | 21 ppm | 1720 ppm | | | | Crude protein Min. 3·6* Crude Fat Min. 1·0* Crude Fibre Max 4·8* |
| Denmark Cobalt Lick | 17 | C.S.M.L. . | CUMING SMITH MOUNT LYELL | Limonite, sulphate of Copper, salt | 38·0 | | | | 20·0 | | | 0·14 | 20 ppm | | | | | |
| Mineralized Supplement for Stock | 27 | RAWLEIGHS | The W. T. Rawleigh Co. Ltd. | Salt, sulphur, copperas, sodium phosphate, potassium iodide, calcium carbonate, cobalt sulphate deflorinated phosphate mineral oil, molasses, drug mixture | 15·0 | 12·24* | 27·0* | | 1000 ppm* | 3·5* | 220 ppm* | | 10 ppm* | | 80 ppm* | | | Calcium (Ca) 13·42* Sodium (Na) 70 ppm |
| Poultry Powder Iodized | 28 | RAWLEIGHS | The W. T. Rawleigh Co. Ltd. | Oyster shell sulphur potassium iodide copperas iodine, sulphate, ground Bone Manganese sulphate, cobalt sulphate zinc sulphate, quassia mineral oil deflorinated phosphate | 16·5 | 38·7* | | | 400 ppm* | 4·0* | 160 ppm* | 40 ppm* | 160 ppm* | 120 ppm* | 40 ppm* | 100 ppm* | | |
| Minerals . | 41 | BLUE-PETER | Agricultural Products Co. | Ground phosphate rock ground limestone limonite, sulphates of minerals and iodax | 10·0 | 5·0* | 29·0* | 1200 ppm | 4·0 | | | 5000 ppm | 550 ppm | 1200 ppm | | 500 ppm | | Boron (B) 200 ppm |
| Medicated Salt Block "B" | 42 | do. | do. do. | Salt ground limestone, limonite sulphates of minerals | 70·0 | | 6·0* | | 1·5 | | | 550 ppm | 95 ppm | 200 ppm | | | | |
| Medicated Calcium | 43 | do. | do. do. | Ground limestone, limonite, sulphates of minerals | 1·0 | | 45·0* | | 3·5 | | | 1500 ppm | 235 ppm | 600 ppm | | | | |
| Stock Conditioner | 44 | LUFT'S BLUE LABEL | Stam Products | Yeast maize oil meal caramel oil of aniseed, boric acid, thiammine-hydrochloride, mineral salt of iron, copper manganese, zinc and cobalt | | | | | 16·46 ppm | Yeast 1·78 | .... | 53·3 ppm | 49·6 ppm | 50·7 ppm | | 56·4 ppm | | Vit $B_1$ 27·7 I.U./lb. Liquid glucose 74·8 |
| Mineral Food supplement for stock | 45 | WATKINS | The J. R. Watkins Co. | Manganese sulphate cobalt sulphate zinc potassium iodide copper sulphate, ground sulphur, sodium chloride, magnesium sulphate, ferrous sulphate, calcium carbonate, ferric oxide, dicalcic phosphate, micronised rock phosphate | 2·0 | 15·5* | 32·0* | 0·7* | 1·1* | | 0·0176 | 0·0129 | 0·01 | 0·009 | | 0·011 | | |
| Mineral Food supplement for Poultry | 46 | do. | do. do. | Calcium carbonate, magnesium carbonate, dicalcic phosphate, bone char, ferric Oxide, ferrous sulphate, magnesium sulphate, ground sulphur, salt, mineral oil, green manganese Oxide cobalt sulphate copper sulphate zinc sulphate, potassium iodide | 10·5 | 15·0* | 33·8* | 0·5* | 1·1* | | 0·0153* | 0·0129* | 0·01* | 0·25* | | 0·01* | | |

* Minimum. † Reputed

| Stock Food. | Applic. No. | Brand. | By whom Registered. | Materials from which Made. | Registered Analysis. | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Sodium Chloride ($NaCl$). | Phosphoric Acid ($P_2O_5$). | Lime ($CaO$). | Magnesia ($MgO$). | Iron ($Fe$). | Sulphur ($S$). | Iodine ($I$). | Copper ($Cu$). | Cobalt ($Co$). | Manganese ($Mn$). | Potassium ($K$). | Zinc ($Zn$). | Other. |
| | | | | | % (Max.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | % (Min.) | |
| **C.—Stock Licks** — *contd.* **3.—*Mixed Stock Licks*—*contd.*** | | | | | | | | | | | | | | | | | |
| "G" Concentrated Sheep Lick | 108 | VIC-LIC .... | Wilcox Mofflin Ltd. | Bone char, iron limonite, copper carbonate, cobalt chloride, potassium iodide | 1·0 | 28·0* | 37·0* | .... | 5·8* | .. | .. | 0·75* | 0·031* | .... | .... | .... | 16 ozs. potassium Iodide added to each long ton |
| "D" Concentrated Sheep Lick | 109 | do. | do. do. | Bone char, iron limonite, sodium sulphate, copper carbonate, cobalt chloride, potassium iodide | 1·0 | 29·0* | 38·0* | .... | 2·9* | .... | .... | 0·75* | 0·031* | .... | .... | .... | |
| Concentrated Cattle Lick | 110 | VIC-LIC .... | Wilcox Mofflin Ltd. | Bone char, iron limonite, salt, potassium iodide | 5·5 | 27·0* | 36·0* | .... | 2·9* | .... | .... | .... | .... | .... | .... | .... | 16 ozs. potassium iodide added to each long ton. Molasses 3·0 |
| Mineralised Salt Block | 111 | do. .... | do. do. | Salt, pulverised limestone, iron limonite, epsom salts, molasses, bone charcoal, potassium iodide | 53·0 | 4·5* | 19·5* | 0·16* | 1·25* | . | .. | .. | .... | .... | ... | .... | |
| Sheep Lick .... | 118 | DAVID GRAY'S | David Gray & Co. Ltd. | Sodium chloride, iron sulphate, copper sulphate, cobalt chloride, manganese sulphate, potassium iodide, potassium chloride, bone meal, yeast | 80·0 | 1·0* | 5·0* | .... | 1·2* | 3·3* | 150 ppm* | 220 ppm* | 92 ppm* | 200 ppm* | 50 ppm* | 80 ppm* | |
| Cattle Lick .... | 119 | do. | do. do. | do. do. do. | 80·0 | 1·5* | 5·0* | .... | 1·2* | 3·3* | 150 ppm* | 220 ppm* | 92 ppm* | 200 ppm* | 50 ppm* | 80 ppm* | |
| Chic-a-vite .... | 130 | VITA-LICK | Goldsbrough Mort & Co. Ltd. | Bone flour, bone charcoal, ferrous sulphate, flowers of sulphur, sodium sulphate, gentian, cod liver oil, potassium iodide, meal from the by-products of rice | .... | 20·2* | 25·9* | .... | 1·7* | 1·7* | .... | Sod. Sul. 6·0* | .... | .... | .... | .... | 16 ozs. potassium Iodide added to each ton. |
| Concentrated Cattle Lick "D" | 132 | do. .... | do. do. | Bone flour, bone charcoal, sodium sulphate, flowers of sulphur, limonite, potassium iodide, copper sulphate, cobalt chloride | .... | 21·2* | 29·0* | .... | 3·4* | 0·4* | ·034* | 0·2* | 0·014* | Sod. Sul. 3·0* | .... | .... | |
| Concentrated "D" | 133 | do. .... | do. do. | Bone flour, bone charcoal, sodium sulphate, sulphur, limonite, potassium iodide | .... | 30·0* | 38·75* | .... | 1·25* | 2·0* | ·034* | .... | .... | .... | Sod. Sul. 1·75* | | |
| Concentrated "D" (Cobaltised and Copperised) | 134 | do. .... | do. do. | Bone flour, bone charcoal, sodium sulphate, limonite, potassium iodide, cobalt chloride, copper sulphate | .... | 22·5* | 30·1* | .... | 1·3* | 2·0* | ·017* | 0·2* | ·014* | .... | Sod. Sul. 1·8* | .. | |
| Concentrated "G" | 135 | do. .... | do. do. | Flowers of sulphur, potassium iodide, bone flour, bone charcoal, limonite | .... | 28·75* | 37·0* | .... | 3·5* | 2·0* | ·034* | .... | .... | .... | .. . | .... | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Concentrated "G" (Cobaltised and Copperised) | 136 | do. .... | do. | do. | Bone flour, bone charcoal, limonite, flowers of sulphur, potassium iodide, copper sulphate, cobalt chloride | .... | 28·75* | 37·0* | .... | 3·5* | 2·0* | ·034* | 0·2* | ·014* | ... | .... |
| Mineral Supplement for Pigs | 137 | POR-CO-VITE | do. | do. | Bone flour, bone charcoal, sodium sulphate, flowers of sulphur, sodium chloride, limonite, calcium carbonate, copper sulphate, cobalt chloride, potassium iodide | 14·0 | 19·14* | 29·32* | . | 0·62* | 9·6* | ·052* | 0·1* | ·003* | ... | Sod. Sul. 2·6 | .... |
| Phosphate Nuts plus Cobalt | 138 | THOMAS .... | W. Thomas & Co. (W.A.) Ltd. | | Pollard, ground phosphate, salt, molasses, cobalt | 10·0 | 9·0* | 11·0* | | . | . | . | . | 50 ppm | . | .... | |
| Sheep Lick .... | 203 | WES-FARMERS | Westralian Farmers Co-op. Ltd. | | Bone meal, common salt, yeast, iron sulphate, copper sulphate, cobalt chloride, manganese sulphate, zinc sulphate, potassium iodide, sulphur | 80·0 | 1·0* | 5·0* | .... | 1·2* | 3·3* | 150 ppm | 220 ppm | 92 ppm | 200 ppm | 50 ppm | 80 ppm |
| Cattle Lick .... | 204 | do. | do. | do. | do. do. do. | 80·0 | 1·0* | 5·0* | .... | 1·2* | 3·3* | 150 ppm | 220 ppm | 92 ppm | 200 ppm | 50 ppm | 80 ppm |

* Minimum.

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